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OF THE

AMERICAN

Geographical and Statistical Society.

M.DCCC.LXX.

VOL. II.—PART 2.

EDITED BY THE RECORDING SECRETARY.

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1870.

XUM

PREFACE.

To the Members and Foreign Correspondents:

During the war of the Rebellion the publication of the Journal has been necessarily suspended, the income of the Society being only sufficient to meet the expenses incurred for the apartments where its collections were placed, and its meetings held, for clerk hire, etc. Throughout this period the meetings were, however, regularly held, and considerable additions were made to the Library and to the valuable collection of maps and charts; but in other respects the Society made comparatively little advance. Having no endowment or permanent fund, but depending solely upon the small income derived from the very moderate annual dues of members, it was not possible to do more; and this state of things would have continued, but for the liberality of the Trustees of the Cooper Union, who have furnished the Society, *free of charge*, with the spacious apartments which they now occupy, consisting of a lecture-room, a room for the Library, a map and chart-room, and an office, in the large building of the Institute devoted by its public-spirited founder, Peter Cooper, Esq., to Science and Art. In these apartments, which form a suite of rooms, and are admirably adapted, from their size and contiguity, as well as from the locality of the edifice, to the purposes of the Society, the Library, now consisting of more than ten thousand volumes, is

placed, and so classified that the books relating to any one subject are as nearly as is practicable brought together. The large and very rare collection of maps and charts is arranged in cases with sliding shelves, so that any map or chart that is desired can be instantly referred to, and those mounted upon rollers are systematically arranged upon a series of racks, and labelled so as to be readily accessible. The Library is believed to be the largest and the most valuable in the country in the particular branch of knowledge to which it is devoted; although still inadequate to meet the demands of science, and far from what should exist in the principal maritime and commercial city of this continent, where this branch of knowledge is of constantly increasing importance. In it will be found a large collection of voyages, travels, and other works relating to nearly every part of the habitable globe. An extensive collection of geographical works and gazetteers, from the earliest cosmographies and geographies to those of the present day. A connected series of Atlases from that of Ortelius in 1573 to the beginning of the present century, embracing the large folios and best editions of Ortelius, De Marre, Mercator, Blaeuw, Doncker, Sanson, Van Homan, Jansen, De Witt, Mortier, Vooght, Van Keulen, Renard, D'Anville, etc., and many others. The transactions of many learned societies in different parts of the world; many works relating to the early history of navigation and of maritime discovery in this country and elsewhere, not to be found in any other public library in the country; and works upon statistics, meteorology, geology, navigation, commerce, physical geography, and kindred subjects, a complete catalogue of which is now in the course of preparation.

Relieved from the payment of rent and other expenses,

the funds of the Society during the past two years have been devoted to the fitting up of its different rooms, and in making necessary additions to the Library, especially of important recent works, in which it was deficient. A portion of its income will hereafter be devoted to the annual publication of its Journal.

During the last summer a valuable collection of geographical works brought to this country by Mr. Henry Stevens, was purchased by a private subscription, and added to the Library, and during the past two years there has been a large increase of resident members, the whole number now amounting to 478.

The Society is free of debt, its expenditures having been kept strictly within its income, and at no period in its past history has its condition and prospects given so flattering an assurance, not only of its permanence, but likewise of its increasing usefulness and prosperity. It remains now only to express the hope, that hereafter some public-spirited citizen, appreciating its importance, will, as has been the case with several institutions of a like character, endow it with a sum of money the annual interest of which will enable the Society to carry out more fully the purposes for which it was founded.

New York, *March*, 1870.

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CHARTER OF INCORPORATION.

GRANTED APRIL 13TH, 1854.

The **People of the State of New York**, represented in Senate and Assembly, do enact as follows:

§ 1. George Bancroft, Henry Grinnell, Francis L. Hawks, John C. Zimmerman, Archibald Russell, Joshua Leavitt, William C. H. Waddell, Ridley Watts, S. DeWitt Bloodgood, M. Dudley Bean, Hiram Barney, Alexander J. Cotheal, Luther B. Wyman, John Jay, J. Calvin Smith, Henry V. Poor, Cambridge Livingston, Edmund Blunt, Alexander W. Bradford, and their associates, who are now or may become hereafter associated for the purposes of this act, are hereby constituted a body corporate by the name of the

American Geographical and Statistical Society, for the purpose of collecting and diffusing geographical and statistical information.

§ 2. For the purposes aforesaid, the said Society shall possess the general powers and privileges, and be subject to the general liabilities contained in the third title of the eighteenth chapter of the first part of the Revised Statutes, so far as the same may be applicable, and may not have been modified or repealed; but the real and personal estate which the said Society shall be authorized to take, hold, and convey, over and above its library, and maps, charts, instruments, and collections, shall not at any time exceed an amount, the clear yearly income of which shall be ten thousand dollars.

§ 3. The officers of the said Society shall be a President, three Vice-Presidents, a Corresponding Secretary, a Recording Secretary, a Librarian, and Treasurer, and such

other officers as may from time to time be provided for by the By-Laws of the said Society.

§ 4. The said Society, for fixing the terms of admission of its members, for the government of the same, for changing and altering the officers above-named, and for the general regulation and management of its transactions and affairs, shall have power to form a code of By-Laws not inconsistent with the laws of this State or of the United States; which code, when formed and adopted at a regular meeting, shall, until modified or rescinded, be equally binding as this act upon the said Society, its officers and its members.

§ 5. The Legislature may at any time alter or repeal this act.

§ 6. This act to take effect immediately.

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STATE OF NEW YORK,
Secretary's Office.

I have compared the preceding with the original law on file in this office, and hereby certify the same to be a correct transcript therefrom and of the whole of said original law.

Given under my hand and seal of office, at the city of Albany, this thirteenth day of April, one thousand eight hundred and fifty-four.

L. S.

A. G. JOHNSTON,
Deputy Secretary of State.

BY-LAWS.

REVISED DECEMBER 9, 1869.

CHAPTER I.

TITLE.

The title of the Society is, "The American Geographical and Statistical Society."

CHAPTER II.

OBJECTS.

The objects of the Society are, "The collecting and diffusing of geographical and statistical information."

CHAPTER III.

MEMBERS.

The Society shall consist of Resident, Non-Resident, Honorary, Corresponding, and Ex-officio members.

1. Resident members are those residing in the city of New York, or its vicinity.

2. Non-resident members are those residing at least twenty-five miles distant from the city.

3. Honorary members shall be chosen on account of their distinction in the science of geography or statistics, and not more than twelve of them shall hereafter be elected in any one year.

4. Corresponding members shall be chosen from those who have aided the advancement of geography or statistics.

5. Ex-officio members shall be foreign diplomatic representatives and consuls, resident in the United States; and United States diplomatic representatives and consuls in foreign countries.

6. Resident, non-resident, corresponding, and honorary members shall be elected as follows: All nominations of candidates shall be openly made in writing at a meeting of the Society, or the Council, by a member thereof, and, together with the name of the member making them, entered on the minutes. The persons thus nominated, when approved by the Council and elected by the Society, shall, on payment of the initiation fee, if nominated as a resident or non-resident member, and without such payment if nominated as a corresponding or honorary member, become members of the Society accordingly.

7. Persons entitled to become ex-officio members of the Society, shall, on the recommendation of the Council, be, by the Society, constituted and declared to be such members.

8. The name of any member of the Society may, on the recommendation of the Council, and by a vote of two-thirds of the members present at a stated meeting of the Society, be dropped from the roll of its members.

CHAPTER IV.

INITIATION FEE AND ANNUAL DUES.

1. The initiation fee, including the dues for the current year, shall be, for a resident member, ten dollars; and for a non-resident member, five dollars; in both cases to be paid immediately on election.

2. The annual dues thereafter shall be, for a resident member, five dollars; and for a non-resident member, two dollars and a half; both to be paid in advance.

3. Any member of the Society, not in arrears, may commute for life all dues for membership, by the payment at one time, if a resident member, of fifty dollars; and, if a non-resident member, twenty-five dollars.

4. The name of any resident or non-resident member of the Society, neglecting for two successive years to pay his annual dues, or at any time wholly refusing to pay them, may, by the Council, be erased from the list of members of the Society.

5. The fiscal year of the Society shall, for all purposes, be the calendar year, that is, commence on the first day of January, and end with the thirty-first day of December, in each year.

CHAPTER V.

OFFICERS.

1. The officers of the Society shall be a President, three Vice-Presidents, a Foreign Corresponding Secretary, a Domestic Corresponding Secretary, a Recording Secretary, a Librarian, a Treasurer, and eight Councillors; and these officers together shall form the Council of the Society.

2. The officers of the Society shall be chosen from among its members; they shall be elected annually by ballot, and shall hold their offices respectively until others are elected in their places.

3. All officers of the Society, to be chosen at any election, may be voted for on one ballot.

CHAPTER VI.

ANNUAL MEETING.

1. The annual meeting of the Society shall be held on the second Tuesday after the first day of January in each and every year hereafter, when the annual election of the officers of the Society shall take place; and if, from any cause, there shall be a failure of the annual election at the time above designated for that purpose, the same may be held on the Tuesday next following, that is, on the third Tuesday after the first day of January in each year, and of which due notice shall be given.

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2. Every member of the Society, who has been such for twenty days or more, and who is not in arrears for his dues, shall be entitled to vote at the said election.

3. At the annual meeting of the Society, the Council shall present a general report of its proceedings, and of those of the Society during the past year, and the Secretaries and Treasurer shall also present their annual reports.

CHAPTER VII.

MONTHLY AND SPECIAL MEETINGS.

1. The Society, unless otherwise specially ordered by the Society or the Council, shall hold its stated meetings for the transaction of business, on the second Tuesday of each month of the year, except July, August, and September.

2. The President, or, in his absence, one of the Vice-Presidents, may, and, upon the written request of five members, shall call a special meeting of the Society, by giving three days' notice thereof in two daily newspapers, published in the city of New York.

CHAPTER VIII.

ORDER OF BUSINESS.

1. At all stated meetings of the Society, for the transaction of ordinary business, the order of proceedings shall be as follows:

1. Reading of the minutes.
2. Reports and Communications from officers of the Society.
3. Reports from the Council.
4. Reports from Committees.
5. Nominations of Members.
6. Special Orders.
7. Unfinished Business.
8. Miscellaneous Business.
9. Papers read and Addresses delivered before the Society.

2. All propositions presented for the action of the Society, at any of its meetings, shall be in writing when requested by the presiding officer, or any member. A proposition, thus presented, when seconded, and the question thereon stated from the chair, shall be deemed to be in the possession of the Society, and open for discussion; but may be withdrawn by the mover, at any time before amendment or decision.

3. No member shall speak more than once upon the same question until all the other members present, desiring to speak, shall have spoken; nor more than twice on any question without leave of the Society.¶

CHAPTER IX.

QUORUM.

At all meetings of the Society, nine members present shall constitute a quorum for the transaction of business.

CHAPTER X.

COMMITTEES.

All Committees, authorized by the Society, shall, unless otherwise specially ordered, consist of three members each, and be appointed by the presiding officer.

CHAPTER XI.

PRESIDING OFFICER.

At all meetings of the Society, on the arrival of the appointed hour, and the presence of a quorum, the President, or, in his absence, one of the Vice-Presidents, or, in the absence of both, a Chairman *pro tem.*, shall immediately take the chair, call the meeting to order, and preside. He shall have only a casting vote. He shall preserve order and decide all questions of order, subject to an appeal to the Society. He shall also, unless other-

wise specially ordered, appoint all Committees authorized by the Society; and, at every annual election, before the opening of the polls, he shall appoint two Tellers of the Election.

CHAPTER XII.

SECRETARIES.

1. Foreign Corresponding Secretary. It shall be the duty of the Foreign Corresponding Secretary to conduct the general correspondence of the Society with individuals and associate bodies in foreign countries.

2. Domestic Corresponding Secretary. It shall be the duty of the Domestic Corresponding Secretary to conduct the Society's general correspondence with individuals and associate bodies in the United States.

3. Both the Foreign and Domestic Secretaries shall keep, in suitable books to be provided for that purpose, at the Society's Rooms, true copies of all letters written by them respectively on behalf of the Society; and shall preserve, on proper files, at the said Rooms, all letters received by them on the same account; and at each stated meeting of the Society or the Council, they shall respectively report their correspondence, and read the same, or such parts thereof as may be required.

4. In case of a vacancy in the office of either of the Corresponding Secretaries, or in the absence or disability of either of these officers, the duties of both may be performed by the other Corresponding Secretary.

5. The Society may designate a particular officer, or appoint a committee to prepare a letter or letters on any special occasion.

6. Recording Secretary. It shall be the duty of the Recording Secretary to give due notice of the time and place of all meetings of the Society, and to attend the same. He shall keep fair and accurate minutes of the proceedings of the Society, and record the same, when approved, in the Society's Journal. He shall give immediate notice to the several officers and commit-

tees of the Society, of all votes, orders, resolves, and proceedings of the Society, affecting them, or appertaining to their respective duties. He shall prepare a list of the members of the Society entitled to vote, to be handed to the Tellers before the opening of the polls at each annual election. He shall officially sign and affix the corporate seal of the Society to all diplomas, and other instruments or documents authorized by the Society or Council. He shall have charge of the corporate seal, charter, by-laws, records, and general archives of the Society, except so far as they may be expressly placed under the charge of others. He shall certify all acts and proceedings of the Society, and shall notify the Council of the death, resignation, or removal of any officer or member of the Society. He shall have charge of the Rooms of the Society, and shall perform all such other and further duties as may, from time to time, be devolved upon him by the Society or the Council. He shall receive, for his services, such salary or pecuniary compensation as shall be determined by the Society or the Council; but neither in the Society nor the Council shall he have a vote on any question relating to, or affecting, his salary or pecuniary compensation.

7. All documents relating to the Society, and under the charge of the Secretaries respectively, shall be placed in such depositories in the Rooms of the Society as the Council may provide and designate for that purpose.

CHAPTER XIII.

LIBRARIAN.

The Librarian, together with the Council, shall have the charge and arrangement of the books, maps, and collections belonging to the Society. He shall cause to be kept in the Rooms of the Society, a Registry of all donations to the Library or collections of the Society, acknowledge their receipt by letter to the donors, and report the same, in writing, to the Society at its next stated meeting.

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CHAPTER XIV.

TREASURER.

The Treasurer shall have charge of, and safely keep, all contracts, certificates of stock, securities, and muniments of title belonging to the Society. He shall collect the dues and keep the funds of the Society, and disburse the same under the direction of the Council; and so often as the said funds in the hands of the Treasurer shall amount to one hundred dollars, he shall deposit the same, in the name of the Society, in some incorporated bank in the city of New York, to be designated for that purpose by the Council; and the said funds, thus deposited, shall be drawn out of the said bank on the check of the Treasurer, countersigned by the Chairman of the Council, and only for the legitimate and authorized purposes of the Society. The Treasurer shall, previous to the annual meeting of the Society, prepare and submit to the Council, for audit, a detailed account of his receipts and disbursements for account of the Society during the past year; and which annual account, duly audited, he shall present, with his general report, to the Society, at its annual meeting.

CHAPTER XV.

COUNCIL.

1. The Council shall have the management and control of the affairs, property, and funds of the Society; and shall designate an incorporated bank in the city of New York, where the said funds shall, from time to time as they accrue, be deposited by the Treasurer.

2. It may frame its own By-Laws not inconsistent with the Charter or By-Laws of the Society.

3. It may, from time to time, determine the salary or pecuniary compensation of the Recording Secretary; and shall also appoint the necessary agents, clerks, and servants of the Society, with such powers, duties, privileges, and compensation, as it may,

from time to time, determine ; and may, at pleasure, revoke such appointments, and make others in their stead.

4. It shall have power to fill, for the unexpired term, any vacancy that may occur in any of the offices of the Society.

5. It shall have power, at its discretion, to declare vacant the seat of any member of its own body (except the President and Vice-Presidents) who shall have been absent from its meetings for three successive months ; and also, by a vote of a majority of the whole Council, to remove, from its own body, any member thereof for cause ; but in such case it shall be the duty of the Council to report every such vacancy or removal to the Society, at its next stated meeting thereafter, when such cases shall be subject to review by the Society.

6. It shall not, without an approving vote of the Society, at a stated meeting thereof, make any contract whereby a liability in amount above one thousand dollars may be incurred by the Society ; nor, without such vote, make any sale or disposition of the property of the Society, exceeding that sum in value.

7. The Council may, in its discretion, remit the initiation fee, or annual dues, of any member of the Society.

8. No member of the Council, except the Recording Secretary, shall receive any salary or pecuniary compensation for his services.

9. The Council shall hold stated meetings for the transaction of business, at least once in every month, except the months of July, August, and September.

10. At all meetings of the Council, five members present shall constitute a quorum for the transaction of business.

CHAPTER XVI.

GENERAL PROVISION AS TO DEBT.

No debt on account of the Society, beyond the funds in the Treasury for its payment, shall, for any purpose, at any time, be incurred ; and if, at any time, it shall appear that there are rest-

ing upon the Society, pecuniary obligations beyond the funds in the Treasury for their liquidation, no appropriation of funds from the Treasury whatever, except for the necessary current expenses of the Society, shall be made, until the said pecuniary obligations shall be fully discharged, or the funds necessary for their extinction shall have been set apart for that purpose.

CHAPTER XVII.

ALTERATION OF THE BY-LAWS.

No alteration in the By-Laws of the Society shall be made unless openly proposed at a stated meeting of the Society, entered on the minutes, with the name of the member proposing the same, and adopted by the Society at a subsequent stated meeting, by a vote of two-thirds of the members present.

CHAPTER XVIII.

ADOPTION OF THE BY-LAWS.

The foregoing are hereby adopted and declared to be the By-Laws of the Society; and all By-Laws of the Society heretofore adopted, are hereby rescinded, and declared to be null and void.

AMERICAN

Geographical and Statistical Society.

OFFICERS AND COUNCIL.

1870.

President.

HON. CHARLES P. DALY, LL. D.

Vice-Presidents.

HENRY GRINNELL, HON. FREDERICK A. CONKLING,
REV. JOSEPH P. THOMPSON, D. D.

Honorary Secretary.

FRANCIS A. STOUT.

Foreign Corresponding Secretary.

HON. TOWNSEND HARRIS.

Domestic Corresponding Secretary.

W. H. H. MOORE.

Recording Secretary.

E. R. STRAZNICKY.

Treasurer.

HENRY CLEWS.

Librarian.

HENRY B. HAMMOND.

Council.

WILLIAM REMSEN,
T. BAILEY MYERS,
THEODORE W. DWIGHT, LL. D.,
LEWIS M. RUTHERFURD,
WILLIAM T. BLODGETT,
WILLIAM E. CURTIS,
GENERAL GEORGE W. CULLUM, U. S. A.,
GEORGE CABOT WARD.

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HONORARY MEMBERS.

BURLINGAME, Anson, Envoy Extraordinary and Minister Plenipotentiary from the Emperor of China to the Treaty Powers.

HIS Imperial Highness the Grand Duke Constantine of Russia, President of the Imperial Geographical Society, St. Petersburg, Russia.

FREMONT, Jno. Chas., LL.D. Mariposa, California.

LAYARD, Austin Henry, D.C.L. London, England.

LIVINGSTONE, David, DD., LL.D.

MCCLINTOCK, Francis Leopold, LL.D. London, England.

MAURY, Matthew Fontaine, LL.D. Washington, D.C.

MIDDENDORFF, Adolph Theodore von, Secretary of the Imperial Academy of Sciences of Russia, St. Petersburg.

MURCHISON, Sir Roderick Impey, D.C.L. President Royal Geographical Society, and Director-General of the Geological Survey of Great Britain and Ireland . . . London.

PETERMANN, Professor Augustus, PH.D. Gotha, Germany.

QUETELET, Lambert Adolphe Jacques, President of the Central Commission of Statistics of Belgium . Brussels.

RAWLINSON, Sir Henry Creswicke, D.C.L. . . London, England.

STRUVE, Otto Wilhelm von, St. Petersburg, Russia.

CORRESPONDING MEMBERS.

ALEXANDER, John Henry, Baltimore, [Md.

ALFORD, Benjamin, U.S.A. Ft. Vancouver, Wash. Ter.

ARCHBALD, Andrew B., Paris, France.

BARCLAY, James T., M.D. Jerusalem, Syria.

BARNARD, Henry, LL.D., Chief, Department of Education, Washington, D. C.

BARTLETT, Jno. Russell, Providence. R. I.

BAZ, Señor Don Juan José, Governor of the District of Mexico.

BRADLEY, Daniel B. (Rev.) . Siam.

BRIGHT, John, M.P. London, England.

BUSHNELL, Albert (Rev.) Gaboon, Equatorial Africa.

CHAIX, Prof. Paul, Geneva, Switzerland.

COLOGERAS, Hon. J. B. Rio Janeiro, Brazil.

COOK, Charles W. San Francisco, California.

DELAPLAINE, GEO. P. . Madison, Wis.

DIXON, Hon. James, Hartford, Conn.

DRAPER, Lyman . . Madison, Wis.

DUER, John K., Lieut. U.S.N. Washington, D. C.

DUNCAN, William H., Hanover, N. H.

EMORY, Wm. H., U.S.A. Washington, D.C.

FOETTERLE, Franz, late Secretary of the Imperial Royal Geographical Society of Vienna, Austria.

GILMAN, Daniel Coit, LL.D., Librarian of Yale College, New Haven, Conn.

GREEN, Thomas J. Washington, D.C.

GULICK, Luther Halsey, M.D. Micronesian Islands.
GUYOT, Prof. Arnold Henry, LL.D. Princeton, N.J.
HEPBURN, Jas. Curtis, M.D. . Siam.
HELLWALD, Friedrich von, Member of the Imperial Royal Geographical Society, Vienna, Austria.
HINES, Wm. E., U. S. Consul Zanzibar, Africa.
HOCHSTETTER, Dr. Ferdinand von, Professor in the University of Vienna, Austria.
HOUGH, Franklin B., M.D., Superintendent of the United States Census Bureau . Washington, D.C.
JAMESON, Wm., M.D. . . Quito.
JULIEN, Alexis A. Island of Sombrero, W.I.
KENNEDY, Jos. Camp. Griffith, late Superintendent of the U. S. Census, Washington, D. C.
KOHL, Johann Georg., PH.D. Vienna, Austria.
LAPHAM, Increase A. Milwaukee, Wis.
LACHLAN, R. . . Cincinnati, O.
LEAVENWORTH, Elias W. Syracuse, N. Y.
LESSEPS, Ferdinand de, Suez, Egypt.
LONG, Stephen H., Col. U.S.A. Louisville, Kentucky.
LYONS, Hon. Caleb . . Idaho.
MCCARTEE, Divie Bethune, M.D. Hong Kong, China.
MCCLELLAND, Robert Washington, D C.
MACLAY, Wm. W., U.S.N. Annapolis, Md.
MALTE Brun, V. A., Honorary Secretary of the Geographical Society Paris, France.
MANSFIELD, Edward D., Commissioner of Statistics of Ohio, Columbus.
MARSH, Hon. George P., LL.D., U.S. Minister . . Florence, Italy.
MARTIN, R. Montgomery, F.R.G.S. London, England.
MARTIN, Rev. Wm. A. P., D.D., Professor of the Imperial College at Pekin, China.
MASON, Charles . Washington, D.C.
MAURY, Louis Ferdinand Alfred, General Secretary of the Geographical Society . . Paris, France.
NEGRI, Christoforo, President Italian Geographical Society, and Chief of the Consular Bureau, Foreign Office Florence, Italy.
NEWMARCH, Wm., Hon. Sec. of the Statistical Society of London, England.
NORMAN, Benjamin M. New Orleans, La.
NYE, Gideon, U. S. Consul Canton, China.
OLIVIERA, B. de . Rio Janeiro, Brazil.
OLRIK, C. S. M., Inspector at Godhavn, North Greenland.
PALMER, Aaron H., Washington. D. C.
PINHEIRO, J. C. Fernandes, M.D. Brazil.
RAE, John, M.D. . Hamilton, Canada
ROMERO, Hon. Mathias, Minister of Finance of Mexico.
SAPUCACHY, M. le Viscomte, Rio Janeiro, Brazil.
SCHADE, Louis, M.D. Washington, D. C.
SEWARD, Hon. Wm. H., LL.D. Auburn, N. Y.
SEYMOUR, Hon. Horatio, LL.D. Utica, N. Y.
SHAW, H. Norton, M.D., Royal Geographical Society, London, England.
SHANKLAND, Thomas, U. S. Consul, Island of Mauritius.
SIMMONS, D. B., M.D. Yedo, Japan.
SMITH, Edward R. Washington, D.C.
SOMERVILLE, Mrs. Mary Fairfax, Florence, Italy.
STANLEY, Edward, Earl of Derby, London, England.
WARNE, Joseph . Oxford, England.

RESIDENT AND NON-RESIDENT MEMBERS.

FEBRUARY 1, 1870.

N. B.—*Those having L. M. preceding their names have compounded for life.*

Year of Election.		
1860		Acton, Thomas C., 19 *West Fifteenth street.*
1869		Aguiar (de) A. W. F., 13 *Broadway.*
1868		Allen, Charles C., 30 *Broad street.*
1869		Allen, Jerome, 3 *East Thirty-third street.*
1853		Alsop, Joseph W., 42 *South street.*
1868		Appleton, William H., 90 *Grand street.*
1859	L. M.	Arnold, Daniel H., 382 *Fifth avenue.*
1859		Arnoux, William H., 52 *Wall street.*
1856		Aspinwall, William H., 54 *South street.*
1869	10	Auchmuty, Richard Tylden, 61 *University place.*
1859	L. M.	Aymar, William, 37 *West Twentieth.*
1869		Badeau, Gen. Adam.
1869		Bailey, James Muehlenberg, 31 *Pine street.*
1856		Baldwin, Simeon, 29 *Wall street.*
1868		Balestier, Joseph N., 35 *Pine street.*
1856		Ball, Henry, 565 *Broadway.*
1856		Baker, Francis, 69 *Worth street.*
1852	L. M.	Bancroft, Hon. George.
1868		Banks, David, Jr., 144 *Nassau street.*
1865		Banvard, John, *Cold Spring Harbor, Long Island.*
1869	20	Banyer, Goldsboro, 13 *West Twenty-first street.*
1868		Barlow, Gen. Francis C., 5 *Beekman street.*
1859		Barlow, S. L. M., 35 *William street.*
1858		Barney, Danford N., 82 Broadway.
1852	L. M.	Barney, Hiram, 111 *Broadway.*
1868		Barrett, William C., 20 *Nassau street.*
1869		Barrow, John W., 350 *Broadway.*
1856		Bayard, Edward, M.D., 8 *West Fortieth street.*
1868		Beardslee, Rufus G., 106 *Broadway.*
1868		Beckwith, N. M., 4 *West Sixteenth street.*

Year of Election.			
1868	30		Beebe, Hon. Welcome R., 74 *Wall street.*
1857			Beekman, James W., 5 *East Thirty-fourth street.*
1870			Bell, George, 20 *West Twentieth street.*
1865			Bellows, Rev. Henry W., D.D., 232 *East Fifteenth street.*
1859		L. M.	Belmont, August, 50 *Wall street.*
1868			Benedict, Erastus C., 76 *Wall street.*
1868			Bennett, James Gordon, Jr., 425 *Fifth avenue.*
1868			Bernheimer, Adolph, 101 *Franklin street.*
1859			Bernheimer, Isaac, 320 *Broadway.*
1868			Bernheimer, Leopold M., 101 *Franklin street.*
1868	40		Bernheimer, Simon, 218 *West Fourteenth street.*
1856			Berry, Richard, 291 *Broadway.*
1869			Bickmore, Prof. Albert, M.A., 59 *Wall street.*
1869			Bierstadt, Albert, 51 *West Tenth street.*
1868			Bill, Edward, 2 *South street.*
1868			Bill, Ledyard, 41 *Park row.*
1868			Bininger, Andrew G., 92 *Liberty street.*
1863			Bishop, Nathan, 5 *Bible House.*
1856			Black, William, 565 *Broadway.*
1868			Blake, Charles F., 7 *Warren street.*
1868	50		Bleecker, T. B., Jr., 61 *William street.*
1860			Blodgett, William T., 252 *Pearl street.*
1869			Bloomfield, William, 132 *Nassau street.*
1868			Blunt, George W., 40 *Burling slip.*
1859			Boardman, Andrew, 128 *Broadway.*
1868			Boesé, Thomas, 134 *East Thirty-eighth street.*
1859			Boorman, J. M., *Scarborough, N. Y.*
1856			Booth, William T., 19 *East Fourteenth street.*
1857			Booth, William F., 3 *West Fourteenth street.*
1869			Brace, Charles L., 19 *East Fourth street.*
1869	60		Bradford, William, 15 *West Tenth street.*
1868			Brady, Hon. John R., 51 *West Thirty-third street.*
1869			Bradley, Stephen Rowe, 13 *Burling slip.*
1856			Brevoort, J. Carson, *Brooklyn, N. Y.*
1862			Bristed, C. Astor, 49 *Lafayette place.*
1854		L. M.	Brodhead, John R., 8 *West Twenty-first street.*
1866			Brown, Ebenezer H., 121 *Nassau street.*
1859		L. M.	Brown, James, 59 *Wall street.*
1853			Brown, James M., 59 *Wall street.*
1856			Brown, Stewart, 59 *Wall street.*
1868	70		Bryan, John, 43 *Broad street.*
1869			Burdett, Charles P., 174 *Water street.*
1853			Butler, Charles, 12 *Wall street.*
1857			Butler, Henry V., 61 *Chambers street.*
1861			Butterfield, Gen. Daniel, 394 *Fifth avenue.*
1855			Camp, Hugh N, 149 *Pearl street.*
1859			Campbell, Malcolm, 27 *Chambers street.*

Year of Election.			
1868			Campion, Jeremiah J., 831 *Broadway.*
1868			Chapman, Joseph H., 51 *Wall street.*
1868			Carter, James C., 66 *Wall street.*
1856	80		Carter, Robert, 530 *Broadway.*
1861			Cary, Lucius E., 90 *Pine street.*
1863		L. M.	Cary, William F., 90 *Pine street.*
1868		L. M.	Catlin, R. W. Stuyvesant, 61 *William street.*
1855			Chanler, Hon. Jno. W.
1859			Chapin, Rev. E. H., D.D., 44 *East Thirty-third street.*
1868			Choate, William G., 49 *Wall street.*
1869			Churchill, Franklin H., 33 *Pine street.*
1868			Cisco, John J., 59 *Wall street.*
1859			Clark, Henry E., 460 *Broome street.*
1859	90		Clason, Augustus W., *Union Club, Fifth avenue.*
1856			Clay, George, M.D., 56 *Clinton place.*
1859			Clift, Smith, 15 *West Twenty-ninth street.*
1864			Clews, Henry, 32 *Wall street.*
1868			Cochrane, Gen. John, 233 *East Twelfth street.*
1856			Coffin, Edmund, 77 *Cedar street.*
1856			Colgate, Charles C., 55 *John street.*
1856			Coleman, William T., 117 *Front street.*
1852		L. M.	Colton, Joseph H., 73 *Beekman street.*
1868			Colyer, Vincent.
1869	100		Conger, Hon. Abraham B., 132 *Nassau street.*
1855			Conkling, Hon. F. A., 170 *Broadway.*
1856		L. M.	Cooley, James E., 78 *Fifth avenue.*
1856			Cooper, Edward, 17 *Burling slip.*
1855			Cooper, Peter, 17 *Burling slip.*
1856			Cornell, William W., 141 *Centre street.*
1868			Coulter, Samuel, 83 *Chambers street.*
1862			Cowdin, Hon. Elliot C., 98 *Grand street.*
1859			Craven, Alfred W.
1856			Crooks, Ramsey, 57 *Front street.*
1856	110		Crowen, Thomas J.
1869			Cullum, George W., Maj.-Gen. U.S.A., *corner Greene and Houston streets.*
1858			Currie, Gilbert E., 153 *Broadway.*
1857			Curtis, James L., 48 *Pine street.*
1856			Curtis, Lewis, 139 *Duane street.*
1856			Curtis, William E., 74 *Broadway.*
1856			Dabney, Charles H., 53 *Exchange place.*
1855			Daly, Hon. Charles P., LL.D., 84 *Clinton place.*
1865			Darling, Cassius, 595 *Sixth avenue.*
1866			Darling, William A., 69 *West Forty-fourth street.*
1868	120		Davies, Hon. Henry E., 149 *Broadway.*
1868			Davis, Ezekiel H., 51 *Wall street.*
1868			Dawson, H. B., 75 *Gold street.*

Year of Election.			
1869			Day, James Geddes, 262 *Broadway.*
1868			De Costa, Rev. B. F., 316 *East Fifteenth street.*
1868		L. M.	Dennis, Charles, 51 *Wall street.*
1864			Detmold, Christian E., 111 *Broadway.*
1856			Detmold, William, M.D., 38 *East Ninth street.*
1868			DeVoe, Col. Thomas F., 104 *West Thirteenth street.*
1859			Dickerson, E. N., 62 *East Thirty-fourth street.*
1864	130		Diehl, Israel S.
1869			Dodge, Anson G. P., 61 *Wall street.*
1869			Dodge, Robert, 12 *Wall street.*
1856			Dodge, Hon. William E., 13 *Cliff street.*
1856			Dodge, William E., Jr., 13 *Cliff street.*
1856			Doremus, R. Ogden, M.D., 227 *Fourth avenue.*
1856			Douglass, Andrew E., 89 *Wall street.*
1868			Draper, Henry, M.D., 271 *Madison avenue.*
1868			Du Chaillu, Paul B., 43 *East Thirtieth street.*
1856			Duncan, Wm. Butler, 11 *Nassau street.*
1855	140		Dunshee, Henry W., 142 *West Tenth street.*
1868			Duyckinck, Evert A., 20 *Clinton place.*
1868			Dwight, Prof. Theo. W., LL.D., 43 *Lafayette place.*
1868			Edmonds, Hon. J. W., 271 *Broadway.*
1852			Elliott, S. M., M.D., 10 *Union place.*
1856			Ellsworth, Henry, 223 *West Fourteenth street.*
1856			Ely, Abner L., 22 *Pine street.*
1868			Emmet, Thomas Addis, M.D., 91 *Madison avenue.*
1869			Emott, Hon. James M., 20 *Nassau street.*
1864			Evans, Walton W., 47 *Exchange place.*
1859	150		Evarts, Hon. Wm. M., 52 *Wall street.*
1853			Eyre, Henry S. P., 174 *Pearl street.*
1864			Faile, Thomas H., 130 *Water street.*
1856			Fernbach, Henry, 19 *Nassau street.*
1856			Fiedler, Ernest, 32 *Broadway.*
1856		L. M.	Field, B. H., 127 *Water street.*
1854		L. M.	Field, Cyrus W., *Gramercy place.*
1856			Field, David Dudley, 4 *Pine street.*
1869			Field, Dudley, 4 *Pine street.*
1860			Field, Rev. H. M., 5 *Beekman street.*
1852	160	L. M.	Field, Hickson W., *Europe.*
1857			Fish, Hon. Hamilton, 104 *East Tenth street.*
1859		L. M.	Fogg, William H., 32 *Burling slip.*
1869			Forsyth, Rev. John, D.D., *Newburgh, N. Y.*
1859			Fowler, Edward P., M.D., 22 *West Twenty-ninth street.*
1859			Fowler, Frederick R., 142 *Front street.*
1868			Frohwein, Theobald, 213 *Stanton street.*
1869			Furniss, William, 35 *Wall street.*

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Year of Election.			
1869			Ganse, Rev. H. D., D.D., 358 *West Twenty-second street.*
1853			Gaillard, Joseph, 34 *South street.*
1868	170		Gambrill, C. D., 6 *Hanover street.*
1868			Gardner, A. K., M.D., 237 *East Thirteenth street.*
1868		L. M.	Gebhard, William H., *Union Club, Fifth avenue.*
1869			Gerard, James W., 17 *Gramercy Park.*
1868		L. M.	Gerry, Elbridge T, 164 *Nassau street.*
1856			Gescheidt, Louis A., M.D., 44 *Clinton place.*
1869			Gilbert, Clinton, 73 *Sixth avenue.*
1868			Gillies, James W., 92 *Wall street.*
1868			Goldsmith, Jacob, 320 *Broadway.*
1859			Gould, Charles, 58 *Wall street.*
1869			Gourlie, John H., 26 *West Seventeenth street.*
1860	180	L. M.	Graham, James L., Jr., 108 *Broadway.*
1859			Graham, R. M. C., 108 *Broadway.*
1868			Green, Andrew H., 31 *Nassau street.*
1868			Greene, Gen. G. S., 119 *West Thirty-ninth street.*
1852		L. M.	Green, John C., 71 *South street.*
1857		L. M.	Green, John W., M.D., *Syosset, L. I.*
1856			Greenwood, Isaac I., 214 *West Fourteenth street.*
1868			Gregory, Dudley S., *Jersey City, N. J.*
1852			Grinnell, Henry, 45 *William street.*
1853			Grinnell, Moses H., 111 *Fifth avenue.*
1859	190	L. M.	Griswold, George, 72 *South street.*
1856			Guernsey, Egbert, M.D., 18 *West Twenty-third street.*
1864			Guernsey, R. S., M.D., 151 *Broadway.*
1869			Habicht, C. E., 127 *Pearl street.*
1869			Hadden, Jno. A., 33 *Chambers street.*
1868			Hall, Elial F., 37 *Nassau street.*
1868			Hall, Gen. Wm., 543 *Broadway.*
1869			Hallock, Mrs. Francis, 140 *East Fifteenth street.*
1869			Halsted, William M., 378 *Broadway.*
1864			Hammond, Henry B., 20 *Nassau street.*
1869	200		Harland, Edward, *Norwich, Ct.*
1857			Harris, Elisha, M.D., 301 *Mott street.*
1868			Harris, Hon. Townsend, *Union Club, Fifth avenue.*
1870			Harrison, Thomas F., 146 *Grand street.*
1868			Hartt, Prof. Chas. F., M.A., *Ithaca, N. Y.*
1859		L. M.	Havemeyer, Jno. C., 335 *West Fourteenth street.*
1868			Hayes, Isaac I., M.D., 20 *East Fifteenth street.*
1869			Hays, William J., 51 *West Tenth street.*
1869			Hazard, Rowland R., Jr., 110 *Broadway.*
1868			Hegeman, William, 203 *Broadway.*
1868	210		Hegeman, William A. Ogden, 55 *Pine street.*
1859			Henderson, John C., 464 *Broome street.*
1856			Herring, Silas C., 251 *Broadway.*

Year of Election.			
1856			Hewitt, Abram S., 17 *Burling slip.*
1868			Hewlett, John D., 51 *Wall street.*
1857			Heye, Ernest, 87 *Beaver street.*
1869			Hoffmann, Friedrich, PH.D., 64 *Sixth avenue.*
1868			Hoguet, Robert J., 112 *Duane street.*
1858		L. M.	Holton, David P., M.D., 124 *West Fifty-fourth street.*
1856			Homans, Sheppard, 146 *Broadway.*
1868	220		Hoppin, William J., 59 *Pine street.*
1868			Hoyt, David, 286 *Cherry street.*
1869			Hoyt, Gabriel, 286 *Cherry street.*
1865			Hull, Amos G., 41 *Park row.*
1869			Hull, Col. Harmon D., 11 *Water street.*
1856			Hunt, Wilson G., 82 *White street.*
1856			Hunter, James, 220 *East Tenth street.*
1868			Huntington, Daniel, 49 *East Twentieth street.*
1868			Hurlbert, William H., *World Office.*
1869			Hutchins, Waldo, 40 *Wall street.*
1859			Ireland, John B., 200 *Broadway.*
1868	230		Jacob, Ephraim A., 306 *Broadway.*
1868			Jarvis, Nathaniel, Jr., 124 *West Twenty-third street.*
1868			James, Julian P., 400 *Fifth avenue.*
1852		L. M.	Jay, John, U. S. Ambassador, Vienna, Austria.
1855			Johnson, Bradish, 110 *Front street.*
1868			Johnson, Hezron A., 65 *Broadway.*
1868			Johnson, Henry W., 87 *Wall street.*
1856			Johnston, James B., 90 *Broadway.*
1868			Jones, Charles C., Jr., 61 *Wall street.*
1852		L. M.	Jones, John D., 51 *Wall street.*
1868	240		Joy, Prof. Chas. A., *Columbia College.*
1870			Kane, I. Grenville, *Union Club, Fifth avenue.*
1869			Kapp, Frederick, 4 *Wall street.*
1855			Kearney, Edward.
1869			Kelly, Eugene, 21 *Nassau street.*
1865			Kennedy, John A., 300 *Mulberry street.*
1854			Kennedy, Robert L., 29 *Nassau street.*
1856			Ketchum, Hiram, 29 *William street.*
1865			King, George, 5 *Mercer street.*
1863			King, Oliver K., 31 *Broadway.*
1852	250		Kingsland, A. C., 114 *Fifth avenue.*
1868			Kirkland, Hon. Charles P., 21 *Nassau street.*
1853		L. M.	Knapp, Shepherd, 33 *Wall street.*
1862			Lambert, E. W., M.D., 92 *Broadway.*
1868			Lane, Smith E., 169 *Broadway.*
1856			Lanier, J. F. D., 29 *Pine street.*

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Year of Election.			
1859		L. M.	Lathers, Richard, 29 *William street.*
1868			Lawrence, Abraham R., 25 *Nassau street.*
1869			Lawrence, John S., 11 *South William street.*
1868			Lawson, James, Jr., 62 *Wall street.*
1852	260	L. M.	Leavitt, Rev. Joshua, D.D., 3 *Park place.*
1868			Lee, Gideon, 76 *Irving place.*
1854			Lefferts, Marshall, 145 *Broadway.*
1859			Lenox, James, 53 *Fifth avenue.*
1868			Leonard, William H., 62 *Wall street.*
1868			Leslie, Frank, 537 *Pearl street.*
1860			Lieber, Prof. Francis, LL.D., 48 *East Thirty-fourth street.*
1852		L. M.	Livingston, Cambridge, 145 *Broadway.*
1856			Lockwood, Le Grand, Jr., 94 *Broadway.*
1857			Low, A. A., 31 *Burling slip.*
1869	270		Lydig, Philip M., 34 *Laight street.*
1868			MacKellar, William, 3 *Tryon row*
1863			Mackie, Robert, 24 *Beaver street.*
1869			MacLane, Allan, 59 *Wall street.*
1869			Maclay, Hon. William B., 9 *Nassau street.*
1856			Manners, David S., 173 *Broadway.*
1868			Marsh, Luther R., 170 *Broadway.*
1856			Marsh, Samuel, 98 *Duane street.*
1863			Marshall, Chas. H., 40 *Burling slip.*
1868			Martin, Isaac P., 31 *Nassau street.*
1869	280		Martine, Randolph B., 31 *Nassau street.*
1868			Marquand, Henry G., 43 *Wall street.*
1856			Mason, Sidney, 130 *Fifth avenue.*
1868			Matsell, George W., 3 *Tryon row*
1863			May, Lewis, 5 *Mercer street.*
1868			McClure, George, 550 *Broadway.*
1868			McLean, James M., 156 *Broadway.*
1868			McLean, Samuel, 133 *Duane street.*
1859			McMullen, John, 900 *Broadway.*
1870			Menzies, William, 31 *Nassau street.*
1863	290		Merrick, John S., 139 *Broadway.*
1869			Miller, Charles R., 474½ *Broadway.*
1868			Miller, Edmund H., 20 *Broad street.*
1858			Minturn, R. B., 78 *South street.*
1856			Minturn, T. R., 115 *Pearl street.*
1868			Mitchell, Grove P., 51 *Wall street.*
1856			Mitchill, Samuel L., 30 *Broadway.*
1856			Monroe, Ebenezer, 565 *Broadway.*
1868			Montgomery, Archibald G., Jr., 35 *Wall street.*
1869			Montgomery, Major James E., U.S.A.
1868	300		Moreau, John B., 14 *Second street.*
1859		L. M	Moore, Frank, *Paris.*

Year of Election.			
1853		L. M.	Moore, George H., *N. Y. Historical Society.*
1869			Moore, Henderson, 51 *Greene street.*
1863			Moore, W. H. H., 51 *Wall street.*
1856			Morgan, Hon. E. D., 54 *Exchange place.*
1865			Morgan, William D., 70 *South street.*
1859			Morrell, William H., 34 *West Twenty-fifth street.*
1870			Morris, Harry M., 49 *West Thirty-eighth street.*
1866			Morris, Robert R., *New Rochelle, N. Y.*
1868	310		Morrison, Henry, 200 *Broadway.*
1864			Morton, Levi P., 30 *Broad street.*
1860			Morse, Prof. Samuel F. B., LL.D., 5 *West Twenty-second street.*
1868			Mount, William S., 150 *Duane street.*
1869			Mount, Richard E., Jr., 46 *Exchange place.*
1869			Mumford, John P., 2 *East Thirty-seventh street.*
1856			Murdock, U. A., 7 *Nassau street.*
1868			Murphy, Hon. Henry C., *Brooklyn, N. Y.*
1863			Murphy, Thomas, 33 *East Thirty-ninth street.*
1852			Myers, Col. T. Bailey, 127 *Mercer street.*
1870	320		Naphègyi, Dr. G., 26 *Park place.*
1868			Newberry, Prof. Jno. S., M.D., *Columbia College.*
1856			Niblo, William, 50 *West Twenty-eighth street.*
1856			Nichols, Effingham H., 9 *Pine street.*
1868			Nicoll, Henry, 30 *Pine street.*
1868			Nicoll, Matthias, 51 *Wall street.*
1859			Norrie, Adam, 303 *Fifth avenue.*
1856			Norton, Robert, 1 *State street.*
1856			Oakley, Edward J., 257 *Broadway.*
1869			O'Conor, Charles, 61 *Wall street.*
1868	330		Ogden, Alfred, 51 *Wall street.*
1859			Ogden, William B., 52 *Wall street.*
1857			Opdyke, George, 25 *Nassau street.*
1869			O'Rielly, Henry, 24 *Pine street.*
1868			Pardow, Robert, Jr., 10 *Wall.*
1869			Parker, John A., 39 *William street.*
1868			Parton, James, 303 *East Eighteenth street.*
1868			Paulison, Jno. P., 52 *Wall street.*
1869			Perault, George, 292 *Pearl street.*
1868			Peyton, George, 10 *Wall street.*
1868	340		Pfeiffer, Carl, 4 *Broad street.*
1862			Phillips, George W., 92 *Broadway.*
1860		L. M.	Phelps, Royal, 45 *Exchange place.*
1868			Philbin, Stephen, 707 *Broadway.*
1855			Pierrepont, Hon. Edwards, 16 *Wall street.*
1852		L. M.	Pierrepont, Henry E., 58 *Broadway.*
1868			Pierson, Henry L., Jr., 24 *Broadway.*

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Year of Election.			
1852		L. M.	Poor, Henry V., 57 *Broadway.*
1860			Potter, Clarkson N., 61 *Wall street.*
1868			Powers, William P., 74 *Broadway.*
1852	350	L. M.	Prime, Frederick, 26 *Broad street.*
1859		L. M.	Prime, Frederick E., 26 *Broad street.*
1868			Prime, Rev. Wm. C., 76 *Beaver street.*
1869			Pruyn, Hon. John V. L., LL.D., *Albany, N. Y.*
1868			Pumpelly, Raphael, 43 *Lafayette place.*
1859		L. M.	Punnett, James, 46 *Wall street.*
1859			Purser, George H., 82 *Nassau street.*
1868			Putnam, George P., 661 *Broadway.*
1856			Randolph, A. D. F., 770 *Broadway.*
1859			Rapallo, Charles A., 218 *Broadway.*
1868	360		Raven, Anton A., 51 *Wall street.*
1859		L. M.	Reckendorfer, Joseph, 59 *John street.*
1866			Reid, Jared, Jr., *Perth Amboy, N. J.*
1868			Redfield, Amasa A., 20 *Nassau street.*
1869			Reid, Capt. Mayne, 33 *Union square.*
1856			Remsen, William, 5 *Wall street.*
1868			Rhinelander, Wm. C., 246 *Greenwich street.*
1856			Richards, Joseph W., M.D., 12 *Clinton place.*
1868			Richmond, Henry A., *Buffalo, N. Y.*
1856			Riker, John H., 150 *Nassau street.*
1869	370		Roberton, John, *Everett House.*
1868			Roberts, Marshall O., 126 *Warren street.*
1868			Rœhrig, F. L. O., PH.D., *Ithaca, N. Y.*
1861		L. M.	Rogers, C. B., 280 *Fifth avenue.*
1869			Rogers, David L., M.D., 209 *Lexington avenue.*
1869			Roosevelt, Theodore, 94 *Maiden lane.*
1868			Rose, Cornelius, 320 *Broadway.*
1854			Ruggles, Hon. Samuel B., 6 *Wall street.*
1852		L. M.	Russell, Archibald, 21 *West Tenth street.*
1868			Russell, John A., *P. O. Box* 2289.
1854	380		Rutherfurd, L. M., 104 *East Tenth street.*
1869			Sabin, Joseph, 84 *Nassau street.*
1856			Sampson, Joseph, 2 *Bond street.*
1868			Sanger, A. L., 243 *Broadway.*
1869			Savage, John, 823 *Broadway.*
1859		L. M.	Schell, Augustus, 40 *Wall street.*
1870			Schell, Richard, 22 *West Twenty-first street.*
1856			Schermerhorn, W. C., 68 *Wall street.*
1856			Schieffelin, S. A., 170 *William street.*
1869			Schmidt, Oscar E., 22 *Burling slip.*
1856	390		Schuchardt, Frederick, 40 *Exchange place.*
1868			Schultz, Jackson S., 343 *Pearl street.*
1859		L. M.	Schultz, John H., 9 *Spruce street.*

Year of Election.			
1856			Sears, Herman B., 18 *Maiden lane.*
1854			Sewall, Henry F., 78 *South street.*
1868			Seward, Clarence A., 29 *Nassau street.*
1868			Shea, George, 54 *William street.*
1856			Sherman, W. Watts, 11 *Nassau street.*
1868			Sherwood, John D., 35 *Wall street.*
1869			Slevin, James M., 261 *Broadway.*
1868	400		Slimmon, Robert, 116 *Duane street.*
1868			Smales, Holbert, 33 *Wall street.*
1868			Smith, Augustus F., 31 *Nassau street.*
1868			Smith, C. Bainbridge, 115 *Broadway.*
1853			Smith, James O., M.D., 81 *Clinton place.*
1856			Smith, Uriah J., 30 *Broadway.*
1868			Spencer, Charles S., 8 *Beach street.*
1869			Spilthorn, Charles L., 83 *Nassau street.*
1856			Spofford, Paul N., 23 *Nassau street.*
1868			Squier, Hon. E. George, 135 *East Thirty-ninth street.*
1860	410		Stansbury, Edward A., 231 *Broadway.*
1859			Stallknecht, F. S., 37 *Nassau street.*
1856			Stebbins, Henry G., 40 *Broadway.*
1870			Stephens, Edward, *St. Cloud Hotel.*
1864			Sterling, Clarence, *Bridgeport, Conn.*
1869			Stern, Simon, 35 *Wall street.*
1859			Stewart, A. T., 355 *Fifth avenue.*
1860			Stout, Francis A., 21 *East Ninth street.*
1858			Straznicky, E. R., *Astor Library.*
1869			Strebeigh, Robert M., *Clinton Hall.*
1859	420		Strong, Geo. T., 68 *Wall street.*
1860			Stuart, Alexander, 167 *Chambers street.*
1855			Stuart, Robert L., 169 *Chambers street.*
1856			Sturgis, Russell, 40 *Burling slip.*
1861		L. M.	Suckley, George, M.D.
1868			Suydam, Henry, 51 *West Twenty-second street.*
1869			Sweeney, Hon. Peter B., 140 *West Thirty-fourth street.*
1857			Taylor, Bayard.
1868			Taylor, Douglas, 89 *Nassau street.*
1869			Tellkampf, Herman D., 65 *Broadway.*
1855	430		Tellkampf, T. A., M.D., 142 *West Fourth street.*
1856			Tiffany, Charles L., 550 *Broadway.*
1868			Tilden, Samuel J., 118 *East Twentieth street.*
1861			Thomson, Wm. H., M.D., 111 *West Forty-third street.*
1857		L. M.	Thompson, David, 52 *Wall street.*
1854			Thompson, Rev. Joseph P., D.D., 32 *West Thirty-sixth street.*
1856			Townsend, Randolph W., 247 *Broadway.*
1859			Tracy, Charles, 50 *Wall street.*
1857			Tremain, Edwin R., 54 *Broad street.*
1859			Turney, P. W., 110 *Broadway.*

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Year of Election.			
1868	440		Van Cott, Hon. Joshua M., 15 *Nassau street.*
1869			Vanderpoel, Aaron J., 291 *Broadway.*
1868			Van Santvoord, C., 6 *Hanover street.*
1868			Van Vorst, Hon. Hooper C., 106 *Broadway.*
1859			Varnum, Joseph B., 110 *Broadway.*
1859			Verplanck, Hon. Gulian C., 67 *University place.*
1854			Viele, Gen. Egbert L., 115 *Broadway.*
1869			Vincent, Rev. J. H., 805 *Broadway.*
1854			Waddell, Wm. Coventry H., 11 *Pine street.*
1869			Wadsworth, E. Clifford, *Brooklyn, E. D., N. Y.*
1859	450		Wainwright, Jno. Howard, 37 *Wall street.*
1862			Walbridge, Gen. Hiram, 12 *Bridge street.*
1868			Walker, Wm. Augustus, 62 *Wall street.*
1869			Ward, Elijah, 59 *Broadway.*
1859			Ward, George C., 52 *Wall street.*
1856			Warren, James K., 65 *Warren street.*
1853		L. M.	Watts, Ridley, 22 *East Twentieth street.*
1854			Webb, William H., 200 *Lewis street.*
1869			Weber, Leonard, M.D., 33 *East Twenty-seventh street.*
1870			Webster, Sidney, 243 *East Eighteenth street.*
1866	460		Wendell, Jacob, 59 *Worth street.*
1868			Wells, J. H., *Fifth Avenue Hotel.*
1869			Welles, James H., *Fifth Avenue Hotel.*
1865			Wells, Samuel R., 389 *Broadway.*
1856			Wetmore, David, 365 *Greenwich street.*
1854		L. M.	Wetmore, Samuel, 59 *Pine street.*
1856			Westermann, B., 471 *Broadway.*
1870			Whitaker, Thomas A., *Union Club, Fifth avenue.*
1868			White, Alexander M., 63 *Broadway.*
1868			Whitney, James A., 189 *Broadway.*
1868	470		Whitewright, Wm., Jr., 88 *Wall street.*
1860			Winston, Frederick S., 144 *Broadway.*
1868			Williams, B., 41 *East Thirty-eighth street.*
1857			Wilson, Harris, *Brooklyn.*
1854		L. M.	Witthaus, G. H., 318 *Broadway.*
1854		L. M.	Witthaus, R. A., 546 *Pearl street.*
1859			Wolfe, John D., 13 *Madison avenue.*
1869			Wreaks, Charles F., 54 *William street.*
1868	478		Zborowski, Martin.

PART I.

TRANSACTIONS OF THE SOCIETY FOR THE YEARS 1868, 1869, AND 1870.

TRANSACTIONS OF THE SOCIETY FOR 1868.

Society's Meeting, May 7th, 1868. Hon. CHARLES P. DALY, the President, in the chair.

On motion of Mr. T. Bailey Myers, the reading of the minutes of the last meeting, held on the 4th day of April, 1867, was dispensed with.

The following new nominations for membership were then made by Hon. Charles P. Daly: Wm. H. Appleton, Dudley S. Gregory, Samuel Coulter, George Peyton.

They were severally referred to the Council for approval.

On motion of Mr. Myers, seconded by Mr. Stout, the following resolution was unanimously adopted:

Resolved, That the thanks of the American Geographical and Statistical Society are hereby presented to Peter Cooper, Esq., and to the Board of Trustees of the Cooper Union, for the valuable assistance they have extended to the Society in its reorganization, and for the liberal accommodations they have appropriated and fitted for their use.

General Thomas L. Kane, of Pennsylvania, was then introduced, and read a paper upon the newly acquired Territory of Alaska, considered as a base for future explorations of the North Pole.

After the reading of the paper, Dr. Hayes, the well-known Arctic Explorer, by invitation of the President, expressed his views with regard to the project for future Arctic explorations, which he did by saying, that, although he was himself committed to the route by way of Smith Sound, no prejudice should exist as to the line of exploration, and that he heartily endorsed the views of General Kane.

On motion of Mr. Stout, seconded by Mr. Blodgett, the following preamble and resolution were offered and unanimously adopted, to wit:

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Whereas, There is reason to believe that the Northwestern Territory, recently ceded to the United States by the Russian Government, possesses resources in productions and naval facilities of much greater value and importance than has heretofore been generally supposed, and that its rapid development by explorations in geodesy and natural history is deemed to be highly important to the interests both of science and of commerce; therefore,

Resolved, That the officers of the Society be requested to prepare and transmit to Congress a memorial, asking the earliest possible action to secure a proper survey and examination upon the coast and within the Territory of Alaska, by officers of the Coast Survey, and others of competent scientific ability and experience.

The Chair then appointed Messrs. Stout, Blodgett, and Straznicky as the committee.

On motion of Mr. Stout, seconded by Mr. Cooper, it was unanimously

Resolved, That the thanks of the Society be presented to Gen. Thomas L. Kane for his valuable paper on Alaska, read this evening, and that a copy of it be requested for the archives of the Society.

The Chair then conveyed the thanks of the Society to General Kane, and,

On motion of Mr. Straznicky, the following gentlemen were appointed by the Chair as a committee to prepare suitable nominations for the annual election of officers, on the 14th instant, namely, Messrs. Myers, Blodgett, and W. E. Curtis.

On motion of Mr. Myers, the President's name was added to the Special Committee on Memorial.

On motion, the meeting then adjourned.

Annual Meeting, May 14, 1868. Hon. CHARLES P. DALY, the President, in the chair.

The minutes of the last meeting, May 7, 1868, were read and approved.

The following Annual Reports were then presented:

(*a*) From Hon. Frederick A. Conkling, Chairman of the Council.

(*b*) From Wm. Remsen, Esq., Treasurer, exhibiting a balance in the treasury of $371.54.

(*c*) From the Librarian, T. B. Myers, Esq., showing that since the last Annual Report there had been presented 1,551 volumes and 777 maps, which had been added to the library.

(*d*) From the Foreign Corresponding Secretary, Francis A. Stout, Esq., exhibiting the very satisfactory condition of the correspondence of the Society with foreign scientific societies and governments at the present time.

(*e*) From the Recording Secretary, E. R. Straznicky, relating chiefly to the successful removal and reorganization of the Society.

On motion, the reports were severally accepted and ordered to be placed on file.

The special committee, appointed at the last meeting, on the 7th of May, to prepare suitable nominations for election of officers for the ensuing year, reported the following ticket:

President.—Hon. CHARLES P. DALY, LL. D.

Vice-Presidents.—HENRY GRINNELL, Hon. FREDERICK A. CONKLING, Rev. JOSEPH P. THOMPSON, D. D.

Foreign Corresponding Secretary.—FRANCIS A. STOUT.

Domestic Corresponding Secretary.—CYRUS W. FIELD.

Recording Secretary.—E. R. STRAZNICKY.

Treasurer.—HENRY CLEWS.

Librarian.—H. B. HAMMOND.

Council.—WM. REMSEN, T. BAILEY MYERS, W. T. BLODGETT, Hon. TOWNSEND HARRIS, W. E. CURTIS.

The Chair then appointed Dr. J. W. Richards and Dr. D. P. Holton as tellers.

While the election was proceeded with, the Council reported the names of the following gentlemen as having been recommended for election as resident members: W. H. Appleton, Dudley S. Gregory, Samuel Coulter, George Peyton,

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Sam'l B. Ruggles, Rufus G. Beardslee, Hooper C. Van Vorst, Nath. Jarvis, Jr., Hon. Geo. C. Barrett, Abraham R. Lawrence, Douglas Taylor, Jeremiah J. Campion, Thomas Boesé, Prof. Charles A. Joy, Samuel McLean, Hon. C. P. Kirkland, Jackson S. Schultz, Thomas Addis Emmet, M. D., Martin Zborowski.

No ballot being called for, they were declared duly elected resident members.

The tellers then reported that the gentlemen recommended upon the ticket for election were unanimously elected. Accordingly, they were declared duly elected officers of the Society for the ensuing year.

On motion, the meeting then adjourned.

Annual Report of Council for 1867 *and* 1868.

The Council of the Society respectfully submit the following report for the two years ending on May 1st, 1868:

It is known that during the war of the rebellion, the operations of the Society were for the most part unavoidably suspended. But three public meetings have been held since the annual election for officers in May, 1866. One in commemoration of the life and character of the late lamented President, Francis L. Hawks, D.D., LL.D., on which occasion a eulogy was pronounced by Evert A. Duyckinck, Esq.; the second on April 4, 1867, for the purpose of considering the removal of the Society to its present apartments; the third on the 7th inst., when General Thomas L. Kane, of Pennsylvania, read a paper on the Geography and Resources of the Territory of Alaska.

The generous offer by the Trustees of the Cooper Union of the perpetual use of a suite of spacious, fire-proof rooms, having been accepted at the meeting held on April 4, 1867, the property of the Society, consisting of the library, maps, charts, atlases, globes, etc., etc., was at once removed from Clinton Hall, under the direction of the Recording Secretary. The rooms, consisting of a Lecture-room, a Library, and Map-room, have been liberally and handsomely fitted up at the expense of the Trustees of the Cooper Union. Several members of the Council have procured, at their own expense, the most recent and complete maps of the principal divisions of the world, and have had them, together with an interesting series of geographical views of Asia, mounted, framed, and hung upon the walls.

They have likewise added to the Library a set of improved globes, and copies of the latest and best atlases which have appeared in England, Germany, and this country.

The Treasurer's Report shows a satisfactory condition of the funds of the Society, as will appear from the following summary :

Total Receipts to May 1, 1868.....	$2,541 33
" Expenditures to May 1, 1868.....	2,169 79
Cash balance in hands of Treasurer.....	$371 54
Annual dues (unpaid).....	300 00
Total Resources.....	$671 54

In addition to this sum, the Treasurer has in his possession the check of Prof. S. F. B. Morse for the sum of.....	$20 00
And that of F. A. Stout, Esq., for the sum of.....	100 00
Total.....	$120 00

If these funds, which have been made applicable by the donors to specific objects, be added to the above-named balance, the resources of the Society will be increased to the sum of $791.54.

The Foreign Corresponding Secretary's Report furnishes gratifying evidence of the high estimation in which the Society continues to be held by many scientific bodies and governments abroad. Notwithstanding the temporary suspension of our own publications and exchanges, we have regularly received their valuable Reports, Transactions, Journals and Public Documents. To the indefatigable labors of Francis A. Stout, Esq., the Foreign Corresponding Secretary, during his recent sojourn in the Old World, the Society is largely indebted for these important additions to its Library.

The Librarian's Report exhibits a highly gratifying condition of his department. Since the date of the last report 408 donations have been received, comprising 11 vols. folio, 119 vols. 4to, 457 vols. 8vo, 69 vols. 12mo, 355 pamphlets 4to, 540 pamphlets 8vo, 777 maps.

Particular attention is invited to the valuable and beautiful atlas of Switzerland by General Dufour, which has been presented to the Society by Prof. Samuel F. B. Morse, together with a check for the sum of $20.00 to defray the expenses of binding the same. It has accordingly been elegantly and substantially bound in red morocco, and can be found on one of the tables in the map room.

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The heirs of the late Prof. Renwick have presented to the Society a very large and valuable collection of books, drawings, maps, and atlases, relating to almost every department of science, and amounting to 341 volumes.

Mr. H. F. Walling's donation of 678 maps, principally relating to North America, and especially to the United States, is also of great value.

The Recording Secretary's Report is very satisfactory in regard to the preservation of the property of the Society, which is placed in his immediate custody. The books, maps, charts, atlases, globes, etc., etc., are now admirably arranged, easily accessible, and, when properly indexed, will be found to be one of the most useful geographical collections on this continent.

The Council avail themselves of this opportunity to place on record their grateful sense of the munificence which the Trustees of the Cooper Union have displayed in their relations with the Society. To Mr. Cooper himself, in an especial manner, our thanks are due for his uniform courtesy and liberality, as well as his personal supervision of the arrangements for our accomodation.

In conclusion, the Council cannot but congratulate the Society upon the cheering prospects now before them of long continued prosperity and usefulness.

F. A. Conkling,
Chairman of Council.

Council Meeting, at the Society's Rooms, Cooper Institute, May 24, 1868.

On motion, Wm. Remsen, Esq., was temporarily called to the chair.

On motion of Judge Daly, the Hon. F. A. Conkling was unanimously elected as permanent Chairman of the Council for the ensuing year, and Mr. E. R. Straznicky as Secretary.

After transacting the usual amount of routine business, the Secretary presented the following very interesting letter from Mr. E. H. Perkins, United States Consul at St. Croix, West Indies:

United States Consulate, St. Croix, W. I.,
Monday, April 20, 1868.

Sir,—Her B. M. ship *Sphinx*, Captain R. A. Hamilton, has recently visited these waters for the purpose of ascertaining if any difference has been made in the soundings by the late earthquakes.

Captain Hamilton informs me that he has discovered no change. I enclose a rough sketch, copied from his deep sea soundings, which may be of some interest to the Society, not only on account of the particular object for which he was sent here by the Admiralty, but also as showing the geological formation of these islands and the practicability of a cable. He remarked to me, that he thought the depth would make those who were thinking of a cable think twice about it as a paying concern! The 1,000 fathoms off Ham's Bluff, *without bottom*, was within one and a half miles of the shore, and proves St. Croix to be the apex of an immense submarine mountain.

I am, with great respect, your ob't serv't,

E. H. Perkins,

U. S. Consul, and ex-officio Member American Geographical and Statistical Society.

To the Secretary American Geographical and Statistical Society, New York.

On motion of the Hon. Charles P. Daly, it was

Resolved, That the thanks of the Society be presented to Mr. Perkins for his highly interesting and valuable communication, and that the same be published in the forthcoming Journal of the Society's Transactions.

On motion, the Council then adjourned.

Society's Meeting, June 12, 1868. Hon. Charles P. Daly, President, in the chair.

The minutes of the last meeting, May 14, 1868, were read and approved.

The Council reported the following gentlemen suitable for election as resident members: C. F. Blake, Andrew G. Bininger, Prof. John S. Newberry, Cornelius R. Agnew, M. D.; J. C. Carter, Jno. D. Sherwood, George W. Blunt, Wm. S. Mount, Gen. John Cochrane, Stephen Philbin, E. George Squier, Frank Leslie, Robert Pardow, Jr., W. C. Barrett, Thomas Murphy, Dr. Isaac I. Hayes, Wm. McKellar, George W. Matsell, Gen. Francis C. Barlow, Col. A. J. H. Duganne, Ephraim A. Jacobs, Charles S. Spencer, Charles B. Hoffman, Wm. J. Hoppin, Alexander M. White, Wm. G. Choate, George Shea, B. Williams, James Parton, Hon. J. W. Edmonds, Augustus F.

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Smith, Isaac P. Martin, John J. Cisco, Luther R. Marsh, Paul B. Du Chaillu, Thomas F. Devoe, David Banks, Jr., Prof. Ch. Fred. Hartt, of Cornell University, as a non-resident member; John B. Moreau, Gen. William Hall, Edmund H. Miller, Col. J. H. Wells, W. H. Hurlbert, Carl Pfeiffer, Rev. B. F. De Costa, Dr. Elisha Harris, Dr. Henry Draper, Theobald Frohwein, Cornelius Rose, Simon Bernheimer, Adolph Bernheimer, Leopold Bernheimer, Adolf L. Sanger, Jacob Goldsmith, Daniel Huntington, William P. Powers, Gen. G. S. Green, Wm. Hegeman, Charles D. Gambrill, Rev. Dr. John Hall, and Prof. Ferdinand Von Hochstetter, of the University of Vienna, Austria, as a corresponding member.

No ballot being called for, all were declared duly elected members of the Society.

The President then introduced to the Society Prof. C. F. Hartt, of Vassar College, Poughkeepsie, who accompanied the Agassiz Expedition to Brazil as a Geologist and Naturalist.

Prof. Hartt gave a very interesting account of the geological features of the coast of Brazil, as far as he had an opportunity to visit the same, describing the process of mining coal and gold, and the formation of coral reefs.

On motion of the Rev. Dr. Thompson, the thanks of the Society were tendered to Prof. Hartt for his interesting and instructive discourse, and a copy of it requested for the archives of the Society.

On motion, the Society then adjourned for the summer season, to meet again in the month of November.

Society's Meeting, November 12, 1868. Hon. CHARLES P. DALY, President, in the chair.

The minutes of the last meeting, June 12, 1868, were read and approved.

Mr. Remsen, on behalf of Council, recommended the following gentlemen for election as resident members: Vincent Colyer, Samuel J. Tilden, Henry Morrison, James W. Gillies, David Hoyt, Henry E. Davies, James G. Bennett, Jr., C. Bainbridge Smith, John R. Brady, Henry G. Marquand,

Holbert Smales, Anthony L. Robertson, John Bryan, Wm. C. Rhinelander, Evert A. Duyckinck, Charles C. Jones, Jr., George P. Putnam, Joseph N. Balestier, Smith E. Lane, Welcome R. Beebe, Clarence A. Seward, Edward Bill, Charles Dennis, John D. Hewlett, Jas. H. Chapman, Anthony A. Raven, Ezekiel H. Davis, Matthias Nicoll, Grove P. Mitchell, Henry W. Johnson, Archibald G. Montgomery, Jr., T. B. Bleecker, Jr., N. W. Stuyvesant Catlin, Wm. Augustus Walker, James Lawson, Jr., John P. Paulison, Alfred Ogden, Julian P. James, George McClure, Wm. A. Ogden Hegeman, N. M. Beckwith, Amasa A. Redfield, Elbridge T. Gerry, Wm. H. Leonard, Joshua M. Van Cott, Henry Nicoll, C. Van Santvoord, Wm. H. Gebhard, and as a corresponding member, Wm. A. P. Martin, D. D., Professor of the Imperial College at Pekin, China.

No ballot being called for, these gentlemen were declared duly elected.

Mr. Henry Clews, Treasurer, presented his report, through Mr. Remsen, which exhibited a balance in the treasury of $432.63.

The Librarian, Mr. H. B. Hammond, being unable to attend, presented his report through Mr. Stout, which showed that since his last report, rendered in May, 1,136 donations had been made to the Library, consisting of books, maps, charts, and atlases, and that the whole collection was now arranged and classified, of which a catalogue and complete index will soon be published.

On motion, the several reports were accepted and ordered on file.

The President then made a few introductory remarks, and stated that he had first to announce, with great regret, the death of Mons. De La Roquette, Honorary Ex-President of the Geographical Society of Paris, and Honorary Member of this Society, a great and useful man, whose loss will be deeply regretted by many scientific societies of which he was an associate. A resolution of condolence will therefore be submitted, to be reported upon at the next meeting.

The President also announced that he had received a dis-

patch from Bombay, dated October 30, which confirmed the reported safety of Dr. Livingstone, and that he was on his way to Zanzibar, thence to proceed to Lake Nyanza, in order to solve the last problem concerning the Nile.

The President reported, in grateful terms, the valuable gift of Mr. George W. Blunt, who presented the Society with a collection of all the books, maps, and charts that had been published by his house since 1793.

The President then introduced to the Society Dr. Isaac I. Hayes, who delivered a most elaborate discourse upon the former plan of reaching the North Pole by way of Smith's Sound, and the establishment of a self-supporting colony in the Arctic regions as a base of operations.

On the conclusion of this most interesting discourse, Mr. T. Bailey Myers, seconded by Mr. Henry Grinnell, moved the thanks of the Society to Dr. Hayes, and requested that a copy of his paper be furnished for the archives of the Society.

Mr. Wm. E. Curtis then submitted the following resolution, which after being seconded was unanimously adopted, to wit:

Resolved, That a committee of three be appointed by the President to prepare resolutions to be submitted at the next meeting, expressive of the sincere respect entertained by the Society for the character and labors of the late Monsieur De La Roquette.

The President then appointed Messrs. Curtis, Stout, and Straznicky as such committee.

On motion, the meeting then adjourned.

Society's Meeting, December 17, 1868. Hon. CHAS. P. DALY, President, in the chair.

The minutes of the last meeting, Nov. 12, 1868, were read and approved.

Mr. Remsen, on behalf of Council, reported the following gentlemen as having been recommended for election as resident members, viz.: Henry L. Pierson, Jr., Robert J. Hoguet, Robert Slimmon, Hon. Henry C. Murphy, Wm. White-

wright, Jr., Prof. Theo. W. Dwight, LL. D., Marshal O. Roberts, H. B. Dawson, Erastus C. Benedict, James M. McLean, Raphael Pumpelly, Chas. C. Allen, Henry Suydam, Rev. W. C. Prime, Gideon Lee, Elial F. Hall, Henry A. Richmond, Hezron A. Johnson, James A. Whitney, F. L. O. Rœhrig, Ph. D., and on the recommendation of the Hon. C. P. Daly, Prof. Albert S. Bickmore, M. A., of Cambridge, Mass., as a corresponding member.

No ballot being called for, these gentlemen were declared duly elected members of the Society.

The Treasurer presented his report, through Mr. Remsen, showing a balance in the treasury of $503.21, which report, on motion, was accepted and placed on file.

Wm. E. Curtis, Chairman of the Special Committee, appointed at the last meeting to draw up suitable resolutions on the death of Monsieur De La Roquette, submitted the following report:

The Committee appointed by resolution at the regular monthly meeting of the American Geographical and Statistical Society, held November 12, 1868, to draft resolutions expressive of the respect entertained by this body for the character and labors of the late Monsieur De la Roquette, Honorary Ex-President of the Geographical Society of Paris, and Honorary Member of this Society, have the honor to submit as their report the following resolutions:

1st. *Resolved*, That the American Geographical and Statistical Society desires to record the great loss it has sustained, in common with other scientific societies, by the death of Monsieur De la Roquette, Honorary Ex-President of the Geographical Society of Paris and Honorary Member of this Society.

2d. *Resolved*, That the efforts of Monsieur De la Roquette in behalf of geographical science, extending over a period of nearly half a century, have been of inestimable benefit to his co-laborers, and merit the earnest appreciation with which they have everywhere been received.

3d. *Resolved*, That in patient zeal and scrupulous exactness in the search after truth, Monsieur De la Roquette had no rivals, and that in trustworthiness his researches rank with the highest.

4th. *Resolved*, That a copy of these resolutions properly en-

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grossed and endorsed by this committee and by the officers of this Society, be forwarded to the family of the deceased savant.

Respectfully submitted.

(Signed) Wm. E. Curtis,
" F. A. Stout,
" E. R. Straznicky.

On motion of Hon. Townsend Harris, the report was accepted, and a copy of it ordered to be transmitted to the family of the deceased.

The President then introduced to the Society, the Rev. B. F. De Costa, who read a very interesting and instructive paper "On the Early Voyages of the Northmen to America."

At the conclusion of this paper, on motion of Mr. Peter Cooper, the thanks of the Society were presented to Mr. De Costa for his valuable paper, and a copy of it requested for the archives of the Society.

On motion, the meeting then adjourned.

Society's Meeting, February 4th, 1869. Hon. Charles P. Daly, President, in the chair.

The minutes of the last meeting, December 17th, 1868, were read and approved.

Mr. Remsen, on behalf of Council, reported the following gentlemen as suitable for election as resident members: Robert M. Strebeigh, Henderson Moore, C. F. Wreaks, A. K. Gardner, M. D., Theodore Roosevelt, Simon Stern, Oscar E. Schmidt, Henry O'Rielly, Gen. Adam Badeau, David L. Rogers, Stephen Rowe Bradley, Edward Harland.

No ballot being called for, these gentlemen were declared duly elected members of the Society.

The Treasurer, not being able to attend, presented his report through the Recording Secretary, exhibiting a balance in the treasury of $743.32.

The Librarian presented his report through the Recording Secretary, showing that 104 volumes were received by donation and 56 by purchase, making a total of 160 volumes.

Both reports were, on motion, accepted and ordered to be placed on file.

The President then introduced to the audience Mr. Paul B. Du Chaillu, the distinguished African traveller and explorer, who read a paper on "Equatorial Africa, with an Account of the Race of Pigmies and of the Cannibal Tribes."

At the conclusion of the reading, on motion of Mr. Archibald Russell, seconded by Mr. W. H. Arnoux, the thanks of the Society were presented to Mr. Du Chaillu, for his very interesting and instructive paper, and a copy of it requested for the archives of the Society.

On motion, the meeting then adjourned.

Society's Meeting, "Special," February 18, 1869. The Rev. Dr. Jos. P. Thompson, Vice-President, in the chair.

On motion, the reading of the minutes of the previous meeting was postponed.

The President then introduced to the Society the Rev. Dr. W. A. P. Martin, Professor of the Imperial College at Pekin, China, who delivered a most interesting discourse upon his experience as a missionary in China, giving a graphic description of the magnificent city of Pekin, with its twenty-three miles of circumference; and of a journey into the interior of China. After enumerating the hidden treasures of coal, iron, silver and gold, which exist in the interior, he gave an account of his visit to that remarkable colony of ancient Jews in the city of Kafu, on the river Huang-ho, which was once the residence of the Imperial Court. Dr. Martin gave also a very interesting account of his visit to the tomb of Confucius, that most remarkable and renowned philosopher.

At the conclusion of Dr. Martin's discourse, on motion of Mr. A. A. Low, seconded by the Rev. Dr. Adams, the thanks of the Society were presented to Dr. Martin for his very able and interesting discourse, and a copy of it requested for the archives of the Society.

Mr. Remsen, on behalf of Council, recommended the following gentlemen for election as resident members: Wm. M.

Halsted, Peter B. Sweeney, Wm. B. Maclay, E. Clifford Wadsworth, Joseph Sabin, Andrew H. Green, John A. Russell; and by the Hon. Chas. P. Daly, as a corresponding member, W. W. Maclay, U. S. N., Annapolis, Md.

No ballot being called for, they were declared duly elected members of the Society.

On motion, the meeting then adjourned.

Society's Meeting, March 18, 1869. Hon. CHARLES P. DALY, President, in the chair.

The minutes of the two previous meetings of February 4, and of February 18, 1869, were read and approved.

The Treasurer's Report exhibiting a balance in the treasury of $833.79, was read and ordered to be placed on file.

The Librarian's Report was read, showing that 494 donations had been received, and giving a list of the principal donors. This was likewise ordered on file.

Mr. Remsen, on behalf of Council, reported the following names as suitable for election as resident members: Philip M. Lydig, Eugene Kelly, Capt. Mayne Reid, Hon. Abraham B. Conger, Charles L. Spilthorn, Hon. Jno. V. L. Pruyn, LL.D., Jno. W. Barrows, Rev. Henry D. Ganse, D.D.; and by Hon. Charles P. Daly, recommended as a corresponding member, Theodore Poesche, Inter. Rev. Dept., Washington, D. C.

No ballot being called for, they were declared duly elected members of the Society.

The President then read a letter from the distinguished missionary, the Rev. Albert Bushnell, at Gaboon, in Equatorial Africa, which he had sent to the Society, with a number of interesting books relating to that part of the country.

On motion of Mr. Myers, a resolution of thanks was passed to Rev. Mr. Bushnell for this very interesting communication, and for his valuable donation.

The President then read a paper prepared by Capt. Silas Bent, of St. Louis, Mo., showing the best practicable route to be pursued by navigators to the North Pole.

On motion of Mr. S. B. Ruggles, the thanks of the Society were presented to Capt. Bent for his interesting and elaborate paper, and a copy of it requested for the archives of the Society.

The President then introduced to the Society Mr. Jno. A. Parker, who read a paper on "Polar Magnetism," showing that the Magnetic Pole is revolving, and that if his theory can be definitely proven, it would immensely benefit the sciences of practical navigation and surveying.

On motion of Mr. Myers, the thanks of the Society were presented to Mr. Parker for his interesting and instructive paper, and a copy of it requested for the archives of the Society.

Dr. Hayes, responding to an invitation of the President, to make a few remarks, after expressing the satisfaction he had experienced in listening to the able paper of Captain Bent, said, that if he could not altogether agree with the Captain as to the best way of getting to the North Pole, he could certainly agree with him as to the importance of getting there one way or another; and in proof of this, if proof were needed, we have it here fresh from the lips of our colleague, Mr. Parker, who has so ingeniously illustrated to us his theory of Polar Magnetism.

You have heard, said Dr. Hayes, his confession of the lack of much necessary information; and, indeed, in every branch of science the student feels seriously the break in the chain of observations which occurs at the North Pole. This link should be supplied. Magnetism is a science which has steadily grown in importance every year, since Columbus first trusted himself to the guidance of the magnetic needle, and first marked with vessel's keel a track across the Atlantic.

The application of steam to commerce, and the discovery of the telegraph, have made the careful study of magnetism a simple necessity. We must know the laws of *variation* if we would mark the shortest passage from port to port. Errors have gradually been eliminated, and great discoveries have been made; but we must still regard the science as in some sense in its infancy; and its laws can, in truth, never be satisfactorily established, until we have recorded observations at the North Pole. I must congratulate the Society upon having its attention so conspicuously drawn to this need by Captain Bent and Mr. Parker. It was a very happy idea of yours, Mr. President, to bring the subject up from a new point of view. We have surely now the right to look at the North Pole from Alaska; and since we own one-half of that little key-hole to the Arctic Ocean,

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Behring Strait, we have surely a right to the key. The line of our territories extends right through that key-hole up to the North Pole, and then down on the other side, and out through another key-hole called Smith Sound.

Then let us get to the North Pole, as I have said before, one way or another, and see what we have obtained by the bargain. I still cling to the Smith Sound route; and even Captain Bent's persuasive earnestness cannot bring me to any other way of thinking. I believe one could get to the North Pole by Behring Strait or by the Spitzbergen Sea; but I have simply a preference for Smith Sound. Perhaps it is because I know it so well, and have already in that direction reached, as did Dr. Kane before me, the open Polar Sea. I would therefore "fight it out on that line." To the scheme which I have proposed I would again ask your attention. Briefly, then:

1*st*.—As to its design. The design of the expedition which I have proposed, is to complete the exploration of the entire region northward of Baffin's Bay; to trace Greenland and Grinnell Land to their termination; to ascertain if other lands lie to the northward; to explore the open sea; and lastly, to reach the North Pole—making upon the course such observations as circumstances will allow. Thus will a field be opened for the most valuable discoveries in Geography, Geology, in Glacier Formations, Magnetism, Ocean Tides and Currents, and in Natural History.

2*d*.—As to plan. I would set out in May with two vessels, one a small steamer, and would make my course northward, parallel with the west coast of Greenland, through the "middle ice," until I reached Smith Sound in lat. 78° 17′, when, in my old harbor of 1860–61, I would pass the winter. Here there is abundance of game, and I would form a colony. Walrus, seals, bears, reindeer, and foxes could be caught in great numbers, and not only would the colony be made self-sustaining in the matter of food, but a valuable cargo of furs and oil might be collected. Then I would push northward the next summer with the steamer, and would thus aim to reach the North Pole. In any case, I would secure a harbor, and a base of operations, much to the north of the colony; and thus would the steamer and the colony become the centres from which the explorations already mentioned would be made.

3*d*.—As to cost. A public-spirited citizen of New York has offered to supply a suitable steamer, and there is good reason to suppose that we could obtain from the Government the loan of a sailing vessel, one of the many not in use. These vessels furnished, they could be equipped and maintained in the field

through two summers and two winters, at a cost of about forty thousand dollars ($40,000).

4th.—Let it be remembered that this is "the American route." The land extends there farther north than in any other quarter, so far as known, and Americans have there explored to within less than eight degrees, that is to say, within four hundred and fifty miles of the Pole. Independent, therefore, of the value to science of this particular line of discovery, above any other in the unexplored parts of the Arctic regions, there is something of national honor involved in the pursuit of it, especially at this time, when England, France, Germany, and Sweden are each aiming to reach the North Pole by various routes; to which end expeditions are actually preparing. Shall we let these nations win from us the coveted honor of priority? I do not believe there is a single person within the reach of my voice who would be indifferent to the matter, and who would not wish to see the "American Flag" first planted at the North Pole.

5th.—As to the advantages of the Smith Sound route over all other routes for discovery in the unexplored parts of the Arctic regions, they are but the simple enumeration which I have before made to the Society, viz.: 1st—Land as a base of operations; 2d—The opportunity to colonize a party of hunters and natives, as the means to a permanent support.

On motion, the meeting then adjourned.

Society's Meeting, April 22, 1869. Hon. CHAS. P. DALY President, in the chair.

The minutes of the last meeting, held March 18, 1869, were read and approved.

Mr. Remsen, on behalf of Council, reported the names of the following gentlemen as suitable for election as resident members: James Geddes Day, Major Montgomery, John A. Parker, John A. Hadden. No ballot being called for, they were declared duly elected members of the Society.

The Treasurer presented his monthly report, exhibiting a cash balance in the treasury of $818.99.

The Librarian also sent in his monthly report, showing that during the past month, by donations and purchases, 214 entries were made.

The President then introduced to the Society Prof. T. Sterry Hunt, LL.D., of Montreal, who read a paper on the

Origin and Cause of Earthquakes and Volcanoes, and in relation to their past and present geographical distribution.

On motion of Dr. Hayes, seconded by Mr. Peter Cooper, the thanks of the Society were presented to Prof. Hunt for his valuable and instructive paper, and a copy of it requested for the archives of the Society.

On motion of Mr. Francis A. Stout, it was

Resolved, That a special committee of three be appointed by the President, to prepare suitable nominations for election of officers for the ensuing year, 1869-70.

The Chair then appointed Messrs. N. M. Beckwith, Dr. I. I. Hayes, and Dr. Theodore A. Tellkampf, as the committee.

On motion, the meeting then adjourned.

E. R. Straznicky,
Recording Secretary.

TRANSACTIONS OF THE SOCIETY FOR 1869.

Annual Meeting of the Society, May 20, 1869. The Hon. CHAS. P. DALY, the President, in the chair.

The minutes of the last meeting, April 22, were read and approved.

The Chairman of the Council reported the names of the following gentlemen suitable for election as resident members: Richard Tylden Auchmuty, Frederick Kapp, Richard E. Mount, Jr., Aaron J. Vanderpoel, Charles O'Conor, James H. Welles, William Furniss.

No ballot being called for, they were declared duly elected members of the Society.

The Hon. Frederick A. Conkling, as Chairman of the Council, read the Annual Report of Council, which, on motion, was accepted and placed on file.

Mr. Remsen, on behalf of Mr. Clews, read the Annual Report of the Treasurer, which, on motion, was accepted and placed on file.

The Librarian, Mr. H. B. Hammond, presented his Annual Report, which, on motion, was accepted and placed on file.

Mr. Conkling, on behalf of Mr. Beckwith, as Chairman of the Nominating Committee, presented their report. The lateness of the hour not permitting an election by ballot, it was, on motion of Mr. Conkling,

Resolved, That Mr. E. A. Stansbury be authorized to cast a collective vote.

Thereupon, the following gentlemen were declared duly elected officers of the Society for the ensuing year:

President.—HON. CHAS. P. DALY, LL. D.

Vice-Presidents.—HENRY GRINNELL, Hon. F. A. CONKLING, Rev. JOSEPH P. THOMPSON, D. D.

Foreign Corr. Secretary.—Hon. Townsend Harris.
Domestic Corr. Secretary.—W. H. H. Moore.
Recording Secretary.—E. R. Straznicky.
Treasurer.—Henry Clews.
Librarian.—H. B. Hammond.
Council.—Wm. Remsen, T. Bailey Myers, Wm. T. Blodgett, W. E. Curtis, Theodore W. Dwight, LL. D.

Mr. Francis A. Stout offered the following resolution, to wit:

Resolved, That Chapter VI., Article 1, of the existing By-Laws, be amended by striking out the words "first Thursday" and "May," and inserting the words "second Tuesday" and "January," so that it shall read: "The Annual Meeting of the Society shall be held on the second Tuesday after the first day of January in each and every year hereafter, when the annual election of officers of the Society shall take place; and if, from any cause, there shall be a failure of the annual election at the time above designated for that purpose, the same may be held on the Tuesday next following, that is on the third Tuesday after the first day of January in each year, and of which due notice shall be given."

That the words, "first Thursday" of Chapter VII., Article 1, be changed to "second Tuesday," so that it shall read: "Shall hold its stated meetings for the transaction of business on the second Tuesday of each month of the year, except July, August, and September."

Which resolution, under the existing By-Laws, must lie over, to be acted upon at the next meeting of the Society.

The President then introduced to the Society Mr. Wm. B. Ogden, who read a paper on the Rise and Progress of the Pacific Railroad.

On the motion of the Hon. Samuel Ruggles, the thanks of Society were presented to Mr. Ogden for his very able and instructive paper, and a copy of it requested for the archives of the Society.

The President then introduced the Hon. Eugene Casserly, who, in complimenting very highly Mr. Ogden for his paper, remarked, among other things, that the people of California owe some recognition to the magnanimous people of the East

for their generous aid in the construction of the Pacific Railroad.

The Rev. Dr. Thompson, in commenting upon the recent death of our distinguished associate, the Hon. George Folsom, offered the following resolutions, which, after being seconded, were unanimously adopted, to wit:

Resolved, That this Society has learned with deep regret of the death of the Hon. Geo. Folsom, one of its founders, and for several years its Vice-President, who departed this life at Rome on the 27th of March last, and that the Society tenders its condolence to his family under this affliction.

Resolved, That the service rendered by Mr. Folsom to the cause of science and letters is an example to gentlemen of means, leisure, and social position, worthy of all commendation; and encourages the hope that, with the development of the wealth of our country, there will arise a taste for an intellectual and æsthetic culture which will crown our material growth with beauty, wisdom, and honor.

Mr. Francis A. Stout offered the following resolution, which, seconded by Mr. Harris, was unanimously adopted, to wit:

Resolved, That the thanks of the Society be presented to the Trustees of the Cooper Union for the public-spirited liberality and uniform courtesy and kindness with which, during the past year, they have placed at the disposition of this Society the spacious and convenient apartments it has had the pleasure and the advantage to occupy.

On motion, the meeting then adjourned.

Report of the Council for the Year ending May 19, 1869.

Rooms of the American Geographical and Statistical Society, New York, *May* 20, 1869.

In presenting the Report of the Proceedings of the Society for the past year, the Council have to congratulate their associates upon the prosperity which has marked its recent history. But little more than one year has elapsed since the Society actually resumed its labors, which were necessarily suspended during the war of the Rebellion. Within that period, not only has there

been a large increase in the number of members, but numerous and most valuable additions have been made to the Library. The finances of the Society have at the same time been placed in a highly prosperous condition, as will appear from the subjoined abstract of the Report of the Treasurer, Henry Clews, Esq. Much, however, remains to be done, and the continued co-operation of the members and friends of the Society is earnestly solicited, to the end that its usefulness may be still further extended.

Balance of funds on hand, May 14, 1868	$371 54
Receipts from all sources since that date	4,805 00
Total amount	$5,176 54
Total expenditures since May 14, 1868	4,332 58
Balance in the hand of Treasurer	$843 96
To this sum may be added, for dues remaining to be collected, the sum of	200 00
Available resources for the ensuing year	$1,043 96

The increase of membership, during the past year, has been as follows:

Number of members on May 14, 1868	249
Number since received	192
Total number	441

The Report of the Librarian shows the following additions, during the year, in his department:

Number of books, pamphlets, maps and charts, added by donation	1,380
Number added by purchase	887
Total additions	2,267

The Library numbers now nearly ten thousand volumes. In its specialty of Voyages, Travels, and Histories, as well as in Maps, Atlases and Charts, it is not too much to say that it is one of the most complete and valuable in the country. It has been carefully arranged and classified, and it is believed that in another year the means will be secured to publish the much desired catalogue.

There have been held during the year nine meetings of the Society and eight meetings of the Council.

1. On May 14, 1868, the last annual meeting of the Society was held and the present Board of Officers was elected.

2. On June 12, 1868, Prof. C. F. Hartt, of Vassar College, now of Cornell University, read a paper on the Geology of Brazil.

3. On November 12, 1868, Dr. Isaac I. Hayes delivered a discourse on the History of Arctic Discovery.

4. On December 7, 1868, a reception was held in honor of the distinguished traveller and explorer, Prof. Robert von Schlagintweit, who gave a very interesting narrative of his Asiatic travels, and particulary of his explorations among the Himalaya Mountains.

5. On December 17, 1868, the Rev. B. F. De Costa read a paper on The Early Voyages of the Northmen to America.

6. On February 4, 1869, Mons. Paul B. Du Chaillu read a paper on Equatorial Africa, giving a particular account of the Race of Pigmies and also of the Cannibal Tribes.

7. On February 18, 1869, Rev. W. A. P. Martin, Professor in the Imperial College at Pekin, in China, delivered a discourse on his Missionary Labors in that country, with an account of his visit to the ancient colony of Jews in Huang-ho.

8. On March 18, 1869, a paper prepared by Capt. Silas Bent, on the Best Practicable Route to the North Pole, was read by the President. On the same evening a paper on Polar Magnetism was read by Mr. John A. Parker.

9. On April 22, 1869, Prof. T. Sterry Hunt, LL.D., of Montreal, read a paper on the Origin and Laws of Earthquakes and Volcanoes in relation to their past and present geographical distribution.

The Foreign Corresponding Secretary, Francis A. Stout, Esq., and the Domestic Corresponding Secretary, Cyrus W. Field, Esq., have both been absent in Europe, during the greater portion of the last year ; and of course have been prevented from personally conducting the business belonging to their respective affairs. The Society is, nevertheless, under great obligation to these gentlemen, for their efficient aid in re-establishing its correspondence and exchange with foreign scientific bodies. To Mr. Stout the Society is especially indebted for a number of rare and valuable geographical works which were procured by him in Europe, and have been generously donated to the Society. Leaving us now for a further visit to the Old World, he has been named as an Honorary Secretary of the Society, and he will continue to exert the same active interest in our affairs for which in times past he has been distinguished. It is proper to add that the duties of both the Foreign and Domestic Corresponding Secretary, have been performed, during the period of their absence, by the Recording Secretary, E. R. Straznicky, Esq. The

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thanks of the Society are eminently due to that gentleman for the admirable manner in which he has discharged the duties in question.

Athough the Recording Secretary has presented no special report of the operations of his immediate office, the Council feel that they cannot too warmly commend his diligence and efficiency. The systematic manner in which the records of the Society have been kept, and the neatness and order of the Society's Rooms attest the ability with which his onerous duties have been uniformly discharged.

In conclusion, the Council desire to place on record the renewed expression of their grateful obligations to the Board of Trustees of the Cooper Union for the courtesy and liberality which have been conspicuous in all their dealings with the officers of the Society.

(Signed) F. A. Conkling,
Chairman of Council.

Annual Report of the Treasurer for 1868.

American Geographical and Statistical Society, New York, *May* 20, 1869.

The Treasurer respectfully submits the following report of the receipts and disbursements from May 14, 1868, to May 19, 1869.

Receipts.

Balance from last year (rec'd of Mr. W. Remsen)...	$371 54
Initiation fees from four life members ($50 each)...	200 00
" " resident members.....	1,540 00
Uncollected dues of 1867.....	50 00
" " 1868.....	387 50
Annual " 1869.....	1,332 50
Subscription to special fund for furnishing new rooms	1,295 00
Total.....	$5,176 54

Expenses.

Salaries of Clerk and Assistant.....	$872 25	
Books, Maps, Globes, and Atlases.....	1,143 64	
Furniture.....	1,034 64	
Stationery.....	129 91	
Printing.....	200 84	
Binding.....	77 00	
Sundries, including postage stamps, advertising, and other expenses with monthly meetings.....	874 20	
		$4,322 58

Leaving balance on hand.....	$843 96
There are uncollected dues for 1869 to the extent of.....	200 00
which, it is believed, can be collected.	
This would leave on hand.....	$1,043 96

HENRY CLEWS,
Treasurer.

Annual Report of the Librarian for 1868.

ROOMS OF THE AMERICAN GEOGRAPHICAL AND STATISTICAL SOCIETY, COOPER INSTITUTE, *May* 20, 1869.

The Librarian would respectfully present the following report for the period commencing with the 14th day of May, 1868, and ending on the 19th day of May, 1869.

The receipt-book of the Library shows that 1,185 entries have been made in that period, which comprises the following:

Donations.

Folios.....	3	volumes.
Quartos.....	87	"
Octavos.....	412	"
12mos.....	27	"
Pamphlets, Quartos.....	72	"
" Octavos.....	462	"
Maps and Charts.....	317	
Total.....		1,380

and also the following

Purchases.

Folios.....	3	volumes.
Quartos.....	143	"
Octavos.....	660	"
12mos.....	12	"
Pamphlets, Quartos.....	21	"
" Octavos.....	22	"
Maps and Charts.....	26	
Total.....		887
Donations and Purchases.....		2,267

The donations have been chiefly received from foreign scientific societies, with which this Society is in regular correspond-

ence, and which continue to transmit their valuable Journals and Transactions. Nothing more can be desired, as to these valuable contributions, than that this Society should reciprocate such generous gifts by the publication and transmission of a Journal of its own Transactions.

There are also included in the list of donors a large number of public officers of the National, State and Municipal Governments, and private gentlemen, whose names it would be impossible to enumerate on this occasion. These will be printed in the forthcoming Journal of the Society's Transactions, which is already in press and soon to be published.

The Librarian cannot omit, however, to call the attention of the Society to the following very valuable and generous gifts, to wit:

That of Prof. Samuel F. B. Morse: The map of the telegraphic system of Europe, published by the Prussian Government.

That of Mr. Francis A. Stout, the Foreign Corresponding Secretary of this Society: A very rare copy of the Atlas of Ortelius, published at Antwerp in 1573; The Atlas of Mercator for 1633; and the costly Mediæval Atlas, by Jomard; and

That of Mr. George W. Blunt: A set of all the maps and charts published by his house since 1793.

The Librarian begs leave to congratulate the Society upon the very satisfactory condition of its Library, which is now arranged and classified, and needs only a catalogue to show to its members its value and completeness in all the departments of geographical and statistical science. It was impossible with the limited means of the Society, and the very large expense incurred during the past year in refurnishing the Society's rooms, to publish a catalogue; but it is hoped that, during the coming year, means can be spared for that purpose.

Respectfully submitted.

HENRY B. HAMMOND,
Librarian.

Society's Meeting, October 14, 1869. Hon. CHAS. P. DALY, President, in the chair.

The minutes of the last meeting, May 20, 1869, were read and approved.

Mr. Beckwith, on behalf of Council, reported the names of the following gentlemen suitable for election, as resident members: John S. Lawrence, C. E. Habicht, James M. Slevin,

John Roberton, Herman D. Tellkampf, Elijah Ward, Wm. Bloomfield, Leonard Weber, M. D., Rowland R. Hazard, Jr., Clinton Gilbert, Randolph B. Martine, Col. Harmon D. Hull, Ledyard Bill, Charles P. Burdett, Hon. James Emott, R. Belloni, John Savage, Robert Dodge, A. W. F. d'Aguiar; and by H. B. Hammond, recommended as a corresponding member, Wm. Neilson Hancock, LL.D., Secretary of the Geographical and Statistical Society of Ireland, in Dublin.

No ballot being called for, they were declared duly elected members of the Society.

The Treasurer reported that there remained a balance in the treasury of $821.14.

The Librarian reported the following accessions to the Library:

By donation	117	volumes.
By purchase	974	"
Maps	9	
Total	1,100	

Both reports, on motion, were accepted and ordered to be placed on file.

The President then introduced to the Society Dr. D. B. Simmons, of New York, for many years a resident of Japan, who read a paper "On the Topography of Japan and the Japanese Earthquakes."

On motion of the Hon. E. Geo. Squier, the thanks of the Society were presented to Dr. Simmons for his interesting and instructive paper, and a copy of it requested for the archives of the Society.

The President then introduced to the Society Mr. Porter C. Bliss, who offered a few remarks on the present condition of the Republic of Paraguay.

On motion of Mr. Beckwith, the thanks of the Society were presented to Mr. Bliss for his interesting remarks.

On motion, the meeting then adjourned.

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Society's Meeting, Nov. 11th, 1869. Professor THEODORE W. DWIGHT, LL.D., in the chair.

The minutes of the last meeting, October 14, 1869, were read and approved.

The Council reported the names of the following gentlemen, suitable for election as resident members: Albert Bierstadt, Franklin H. Churchill, Dudley Field, Professor Albert S. Bickmore, A. M.; A. G. P. Dodge, Wm. J. Hays, Waldo Hutchins, Major-Gen. Geo. W. Cullum, U. S. A., James Muehlenberg Bailey.

By Chas. F. de Loosey, Esq., as a corresponding member: Friederich von Hellwald, Member of the Imperial Royal Geographical Society of Vienna, and of many other scientific societies.

By Paul B. Du Chaillu, Esq., as a corresponding member: Mons. V. A. Malte-Brun, Honorary Secretary of the Geographical Society of Paris.

And by Hon. F. A. Conkling, as an honorary member: Hon. Anson Burlingame, Envoy Extraordinary and Minister Plenipotentiary from the Emperor of China to the Treaty Powers.

No ballot being called for, these gentlemen were declared duly elected resident, corresponding, and honorary members of this Society.

Col. T. Bailey Myers offered the following resolution, to wit:

Resolved, That Chapter V., Section 1, be amended by striking out the word "five," after the words "a Treasurer and," and inserting the word "eight," so that it shall read: "A Treasurer and eight Councillors," instead of "five."

Which resolution, in accordance with the existing By-Laws, was laid on the table, to be acted upon at the next monthly meeting.

The Treasurer presented his report, through the Recording Secretary, exhibiting a cash balance in the treasury of $810.49.

The Librarian reported an increase to the Library, by donation and purchase, of seventy-eight volumes.

On motion, the reports were accepted and ordered to be placed on file.

The resolution of Mr. Francis A. Stout, offered at the last annual meeting on the 20th of May, 1869, relative to the amendment of the existing By-Laws, was now taken up and declared to be adopted.

The President then introduced to the Society, George Gibbs, Esq., of Washington, D. C., who read a paper upon the Physical Geography of the North-Western Boundary of the United States.

On motion of Hon. Henry E. Davies, seconded by Mr. Myers, the thanks of the Society were presented to Mr. Gibbs for his very interesting paper, and a copy of it requested for the archives of the Society.

Dr. Hayes, in responding to a call, not only cordially united in the vote of thanks to Mr. Gibbs, but pointed also to the great similarity of the Western Coast of America with that of Norway and Greenland, which he had an opportunity to observe on his last exploring expedition to Greenland in the summer of 1869.

On motion, the meeting then adjourned.

Society's Meeting, Dec. 9, 1869. Hon. CHAS. P. DALY, President, in the chair.

The minutes of the last meeting, Nov. 11, 1869, were read and approved.

Mr. Myers, on behalf of the Council, reported the names of the following gentlemen as suitable for election as resident members: Frederick Hoffman, Ph. D., James W. Gerard, William Bradford, Rev. John Forsyth, D. D., Jerome Allen, George Perault, John P. Mumford, Allan McLane, Rev. J. H. Vincent, Goldsboro Banyer, Mrs. Frances Hallock; and by Hon. Charles P. Daly, as a corresponding member, his Excellency Señor Don Juan José Baz, Governor of the District of Mexico.

No ballot being called for, these gentlemen were declared duly elected members of the Society.

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The Treasurer's monthly report was read by the Recording Secretary, exhibiting a balance in the Treasury of $563.18.

The Librarian's monthly report was also read by the Recording Secretary, showing that during the past month eighty volumes were received into the Library by purchase and donation.

On motion, both reports were accepted and ordered to be placed on file.

The President then called the attention of the Society to a valuable donation from Dr. Naphègyi, of his Album of Languages, in which the Lord's Prayer is exhibited in one hundred different languages.

The President read also the following letter, which had been addressed to him by Mr. Henry O'Rielly, accompanying a Map of the United States, which he used when arranging early Telegraph routes, and which he presents to the Society:

NEW YORK, *Dec.* 9, 1869.

Hon. CHARLES P. DALY, *President of the American Geographical and Statistical Society:*

DEAR SIR,—Connected with the Origin of Electric Intercourse over extended Lines, and as this is the Anniversary of the Commencement of Telegraphic Correspondence between the Cities on the Atlantic Coast and those on the Mississippi River, I readily comply with the request of your Society, by depositing in your valuable Collection the Map of the United States which I used when arranging early Telegraph Routes—showing the extent of our organized State and Territorial Governments when was completed the First Telegraph Range that connected the Atlantic Cities with the "Father of Waters"—the earliest Public Improvement that united the Mississippi River with the Seaboard.

The Pioneer Lightning Line between St. Louis and the Atlantic Coast (including the intermediate Cities of Harrisburgh, Pittsburg, Wheeling, Columbus, Dayton, Cincinnati, Madison, Louisville, Vincennes, etc.), was the first division of the Range of Eight Thousand Miles of Telegraph, which I projected, constructed, and organized, for connecting the different sections of the United States, *as they then existed*, which was the earliest Great Range of Telegraph in the World.

This Pioneer Line was the first long telegraph used by Scientific Men for Geographical and Astronomical purposes—Prof. Mitchell of Cincinnati thus instantaneously communicating with the Scientists on the Seaboard: And over this line was transmitted the first Presidential Message (Polk's long one of 1847), which was published simultaneously among the People of the Atlantic Coast and of the Mississippi Valley.

I will further comply with the request by furnishing your Library with copies of some of the documents and correspondence concerning the Origin and Progress (or "the Geography and Statistics") of Early Telegraphing in America—referring inquirers, for particulars, to the Collection of One Hundred Volumes of Telegraphic Documents and Correspondence, presented to the New York Historical Society in connection with the Telegraph Lines I organized and with telegraphing generally.

The progress of intercommunication among *all* civilized people and nations, as well as in the United States, cannot be more vividly realized than by considering the development of Railways and Telegraphs during the short period since Telegrams first flashed between St. Louis and the Atlantic Cities—the longest Electric Line then in existence. At that time (Dec., 1847) there were no locomotives west of Chambersburg, in Pennsylvania—not a rail *on the great route* between the Alleghanies and the Pacific Ocean. Between the then railroad terminus and the Mississippi, the common roads, in winter and spring, were mostly in such wretched condition that the mails, then always irregular, were frequently fourteen or fifteen days in transmission—a state of things which rendered telegraphic intercourse valuable to an extent that cannot be realized in these days, when Steam and Lightning are so wonderfully diffused that our newspapers supply intelligence only a few hours old from nearly all parts of the civilized world.

Now mark the contrast!

When the first Telegrams were exchanged between the Mississippi and the Atlantic, the *news*-papers of the Atlantic Cities were often not less than fourteen or fifteen days old before reaching the now great City of the Mississippi Valley—having required one half more time for their journey than was even then required for steam voyages to Europe, and double the time required now for transmitting railroad mails across the Continent—between the Atlantic and Pacific Oceans; facts that may not be deemed uninteresting as illustrations of the revolution effected by Locomotive and Lightning in the intercommunication among mankind of all civilized nations, as well as in the United States of America.

Respectfully yours,

HENRY O'RIELLY.

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On motion of Hon. Townsend Harris it was

Resolved, That the thanks of the Society be presented to Dr. Naphègyi and to Mr. Henry O'Rielly for their valuable donations.

The President then introduced to the Society Prof. J. S. Newberry, of Columbia College, who delivered a discourse upon his explorations in Utah and Arizona Territories.

On motion of the Right Reverend Bishop Potter, seconded by Col. Myers, the thanks of the Society were presented to Prof. Newberry for his highly interesting and instructive discourse, and a copy of it was requested for the archives of the Society.

Miscellaneous business was then again resumed.

On motion of W. H. H. Moore, Esq., the following gentlemen were appointed by the President as a special committee to prepare suitable nominations for the annual election of officers of the Society to be held next month, namely: Messrs. Wm. B. Maclay, Edward Bill, and James Geddes Day.

The resolution of Col. T. B. Myers to amend the By-Laws, Chap. V., Sec. 1, offered at the last meeting, was now taken up and declared to be adopted.

On motion, the meeting then adjourned.

E. R. Straznicky,
Recording Secretary.

TRANSACTIONS OF THE SOCIETY FOR 1870.

Annual Meeting of the Society, January 25, 1870. Hon. F. A. CONKLING, one of the Vice-Presidents, occupied the chair.

The minutes of the last meeting, December 9, 1869, were read and approved.

Mr. Conkling as chairman of the Council read the Annual Report for 1869, which, on motion, was accepted and placed on file.

Mr. Conkling, on behalf of Council, reported the following candidates as suitable for election, as resident members: Harry M. Morris, Sidney Webster, William Menzies, George Bell, Edward Stephens, J. Grenville Kane, Thomas A. Whitaker, Richard Schell, Thomas F. Harrison, Dr. G. Naphègyi; and, on the recommendation of the Hon. F. A. Conkling, as a corresponding member, Hon. Mathias Romero, Minister of Finance of Mexico.

No ballot being called for, these gentlemen were declared duly elected members of the Society.

The Treasurer, Henry Clews, Esq., presented his Annual Report, exhibiting a cash balance in the Treasury of $574. 44. The report, on motion, was accepted and ordered to be placed on file.

The Librarian, H. B. Hammond, Esq., not being able to attend, presented his Annual Report through the Recording Secretary, showing that, in all, 1,426 additions had been made to the Library, by donation and purchase.

On motion, the report was accepted and ordered to be placed on file.

Mr. A. G. Hull, on behalf of the Chairman of the Nomina-

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ting Committee, Mr. Wm. B. Maclay, reported the following gentlemen to be elected as officers of the Society for the ensuing year:

For President.

Hon. CHARLES P. DALY, LL. D.

For Vice-Presidents.

HENRY GRINNELL.
Hon. F. A. CONKLING.
Rev. JOS. P. THOMPSON, D. D.

For Foreign Corresponding Secretary.

Hon. TOWNSEND HARRIS.

For Domestic Corresponding Secretary.

W. H. H. MOORE.

For Recording Secretary.

E. R. STRAZNICKY.

For Treasurer.

HENRY CLEWS.

For Librarian.

H. B. HAMMOND.

Council.

WM. REMSEN.	THEO. W. DWIGHT, LL.D.
T. BAILEY MYERS.	Gen. GEO. W. CULLUM, U. S. A.
W. T. BLODGETT.	LEWIS M. RUTHERFURD.
W. E. CURTIS.	GEO. CABOT WARD.

On motion, it was unanimously

Resolved, That Geo. Bell, Esq., be appointed to cast a collective vote, and that the Hon. Henry E. Davies act as teller.

Whereupon, on motion, the above-named gentlemen were declared duly elected officers of the Society.

The Recording Secretary read a translation of the following letter, which had been addressed to him by Monsieur V. A. Malte Brun, Honorary General Secretary of the Geographical Society of Paris, to wit:

Translation of Mr. Malte Brun's Letter to E. R. Straznicky, Recording Secretary.

PARIS, 21*st December*, 1869.

MONSIEUR AND RESPECTED SECRETARY:

It is with the liveliest pleasure, that I have received the letter of November 15, by which you have the goodness to inform me that the American Geographical and Statistical Society, in their meeting on November 11th, has honored me with the title of a corresponding member.

I feel highly flattered by this honorable distinction, to which I attach a great value, as it brings me in closer contact with distinguished men beyond the Atlantic Ocean, who are so successfully engaged in the exploration and development of our globe.

Will you, therefore, have the kindness and be my interpreter with the members of the American Geographical and Statistical Society, and express to them my most cordial thanks?

I will always be very desirous to keep myself informed on the subject of the labors of your Society, and it will be to me an agreeable duty to make it known on this side of the Atlantic.

We have much regretted the interruption in the publication of the Journal of the American Geographical and Statistical Society, and we are happy to hear that its publication is to be resumed.

Believe me that the Geographical Society of Paris considers it an honor to continue its excellent communications with its zealous sister of New York.

Will you have the goodness, Monsieur, and respected Secretary, to accept the expression of my most distinguished consideration?

(Signed) V. A. MALTE BRUN,
Honorary General Secretary of the Geographical Society of Paris, and Corresponding Member American Geographical Society, 16 Rue Jacob, Paris.

N. B.—Allow me to ask you to present my most sincere compliments to my friend Paul B. Du Chaillu. Please tell him, that at the meeting on the 17th April, 1868, the Geographical Society has awarded him the *Great Silver Medal* for his journey to the Ashango land. This medal is kept for his disposal. He can either withdraw it himself or order the same by a letter addressed to the office of the Geographical Society of Paris, Rue Christine, No. 3. I have ascertained only yesterday the fact that the agent of the Society keeps it safe for him.

I send you by the same mail two pamphlets:

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1. One giving an account of the three projects now on foot for the Exploration of the North Pole.
2. My report on the award of the Gold Medal to Dr. Hayes.

Will you accept them both as a feeble testimonial of sympathy

From your Confrère?

On motion it was unanimously

Resolved, That the thanks of the Society be conveyed through the Recording Secretary to M. Malte Brun, for his very cordial offer to promote the advancement and welfare of this Society.

The Chairman then introduced to the Society the Hon. Charles P. Daly, President of the Society, who delivered the annual address, of which the recent explorations and theories for reaching the North Pole formed the principal subject.

On motion of the Rev. Jos. P. Thompson, D. D., seconded by Dr. Hayes, the thanks of the Society were presented to the President for his elaborate and highly instructive address, and a copy was requested for the archives of the Society.

In moving the vote of thanks, the Rev. Dr. Thompson made the following remarks:

Mr. Chairman,—It is with a proud satisfaction that I rise to move the thanks of the Society to the Honorable President for this address—thanks which I am sure will be tendered with the concurrent unanimity of this assembly.

Before the vote is put I would like the privilege of speaking a few words. This address, so comprehensive in its survey of the whole field of our investigations, so minute and thorough and judicious in its discussion of the particular topic to which it has been devoted, has not only been most instructive to us here assembled, but will be an evidence to the community at large, and to our sister societies abroad, that the American Geographical Society is engaged in its appropriate work, and is making valuable contributions to the cause of science.

You will remember, Sir, as well as I, when there was introduced into the Council of this Society, at its lowest ebb, a gentleman who said: "The first necessity of this Society is a library, in order that it may live."

"Very well," questioned we, "but how can we gather a library from an empty treasury?"

"No matter! It shall be done!"

And finally, by watching the market, we found them coming in with books until our shelves began to groan. And you remember, Sir, that that library at last saved the Society from bankruptcy, from the fact that we had a property *worth preserv-*

ing, which property we owe so largely to the personal influence of the President of the Society. To the President's influence we have been in a large measure indebted for the courtesy we have received from our honored friend Peter Cooper, and those connected with him in the administration of this Institute. And to the same personal influence we are indebted for a large addition to the roll of our members and the increase of our library. I think, therefore, we may felicitate the President of the Society upon the occasion on which we are now assembled. It is a very small compliment on our part so heartily to have re-elected him to this office, an office which we may here say means with him not honor but work, as elsewhere office means with him not emolument but duty.

We are told, Sir, that speech is silver and silence is golden; but there are times when gold itself speaks eloquently. As we have been reminded this evening, it is made the mouth-piece of our sister society of Paris to express its appreciation of the labors of our illustrious fellow-member.

I will not stand in the way of Dr. Hayes, if he shall see fit to address you. I merely add the request that a copy be furnished for the archives of the Society.

Dr. Hayes, in seconding the vote of thanks, spoke as follows:

Mr. Chairman, Ladies and Gentlemen: I would like to add my voice to that of the eloquent gentleman who has just taken his seat, in thanks to the President of the Society for the elaborate and thoroughly comprehensive *resumé* of Arctic discovery which he has given to us this evening. I will not allude to the objects which he has brought to your attention in the early part of the paper, since they do not immediately concern you; but I wish to thank him myself personally for having presented so clearly those questions relating to the sciences—the physical sciences—of the Arctic Regions, which have latterly occupied so large a measure of public attention in this country and in Europe.

With respect to the currents of the Atlantic and the Pacific Oceans which influence the thermometric line of the Arctic Regions, there has been a great deal of misapprehension and a great deal of difference of opinion; and as to whether an open Polar sea does or does not exist, there has been the same variety of judgment; but as to whether there are or are not certain gateways to the North Pole is a question about which many reasonable men declare there cannot be any degree of hoping. The thermometric gateways to the Pole may take their place among those nicely and finely drawn fanciful phrases which, however available they may be in poetry, or in politics, are cer-

tainly quite misplaced in science; and with such phrases scientific men ought to have nothing to do, simply because they have no meaning whatever. There are no thermometric gateways to the Pole except those that are made by hard memory and earnest perseverance. [Applause.] There is no possibility (I agree entirely with Judge Daly) of reaching the Poles in the line indicated in the paper to which Judge Daly has so forcibly alluded. There may be, by following the course of the current that flows into the Arctic Ocean by way of Behring Straits, some possibility of accomplishing this passage toward the new Siberian Islands, and thence across the Arctic Ocean. My own preference for the accomplishment of the passage would be, as I have often illustrated to the Society, by way of Smith Sound, and I am not yet entirely of the opinion that it cannot be accomplished by a steam vessel. I believe that, if I could have continued my voyage last summer with the steam vessel which was unhappily only chartered for three months, I could have pressed through Smith Sound, and have reached the water beyond—at least, I believe the chances were in favor of it. Though the accomplishment of this great project cannot lead to any great commercial route across the globe, yet it is due to science that it should be accomplished. It is one of the great unsolved problems of the age. How far Greenland and Grinnell Land extend toward the North Pole is certainly as important a question of geographical discovery, independent of all other considerations, as the discovery of the source of the Nile, and the region lying beyond it. I have always taken the view that Greenland extends very much to the northward and eastward, and the ices and sand that come down from the North indicate that there are lands in that direction; and I doubt not that that great barrier of ice which blocks up the passage to Nova Zembla is due to the land in that quarter, and that there is no possibility of finding an entrance into the Polar basin by that direction.

I would wish simply, in conclusion, to second the resolution of thanks which is offered by Dr. Thompson, and would also second the request for a copy for publication.

On motion, the meeting then adjourned.

E. R. Straznicky.
Recording Secretary.

Annual Report of the Council for the Year 1869.

ROOMS OF THE AMERICAN GEOGRAPHICAL AND STATISTICAL SOCIETY, COOPER INSTITUTE,
NEW YORK, *January* 25th, 1870.

By an amendment of the By-Laws of the Society, adopted at the regular monthly meeting held on November 11th, 1869, the Annual Meeting and Election of Officers is changed from the month of May to the month of January; consequently only eight months have elapsed since the last Annual Report was presented. The Council have the pleasure again to congratulate their associates upon the continued prosperity and usefulness of the Society. The increase in the number of members has gone on in an augmented ratio, as will be seen from the following summary:

Number of members in May, 1869	441
Number since added	46
Total	487
Number deducted for deaths and resignations	22
Number remaining on January 25th, 1870	465
Net increase since May last	24

The finances of the Society continue to be in a highly satisfactory condition, as will appear from the subjoined abstract of the Report of the Treasurer, Henry Clews, Esq.:

Balance on hand as per last Annual Report	$843 96
Receipts to date	5,445 00
Total	$6,288 96
Expenditures since May 20th, 1869	5,714 52
Leaving balance on hand of	$574 44

The estimate of receipts for the next year is as follows:

Dues of 405 resident members at $5 each	$2,025 00
Uncollected dues of 1869	200 00
Making the available resources for the year 1870	$2,799 44

No estimate has been made of the initiation fees of prospective members, although the receipts from this source during the year will probably amount to several hundred dollars.

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In connection with the Treasurer's Report, it is proper to remark that in the sum total of last year's receipts, amounting, as has been already stated, to $5,445, is included a private subscription for the purchase of a portion of Mr. Henry Stevens' collection of rare geographical books, atlases, and maps, amounting in the aggregate to the sum of $4,845. The names of the subscribers to this fund will appear in the forthcoming volume of the Society's Journal, now in press, and the printing of which is nearly completed.

By the following abstract of the Report of the Librarian, H. B. Hammond, Esq., it will be seen that, within the last eight months, large and valuable additions have been made to the Library:

Number of books and maps added by donation.....	350
" " " " by purchase.....	1,076
Total additions by donation and purchase.....	1,426

Among the purchases is of course included the Stevens Collection, amounting to 761 books, atlases, and maps.

It has been found impracticable, without involving the Society in debt, to furnish at this time the promised catalogue of the Library, but it is believed that in the course of another year this desirable end may be accomplished.

By a second amendment of the By-Laws, which was adopted at the last regular monthly meeting of the Society, held on the 9th of December, 1869, the number of Councillors has been increased from five to eight,—a measure which it is confidently hoped will add to the efficiency of the future management of the Society.

There have been held, since the date of the last Annual Report, four meetings of the Society and five meetings of the Council, in addition to which a reception was given on the 7th of October last to Captain Hall, the distinguished Arctic Explorer, who exhibited a collection of curiosities and relics of Sir John Franklin and his companions, which were obtained by him from the Esquimaux, on his last expedition to the Polar Regions.

On May 20, 1869, the last annual meeting of the Society was held and the present Board of Officers was elected. Wm. B. Ogden, Esq., of Chicago, delivered a discourse upon the Rise, Progress, and Completion of the Pacific Railroad.

On October 14, 1869, Dr. D. B. Simmons, of New York, for many years a resident in Japan, read a paper on the Topography of that country and the Japanese Earthquakes.

On November 11, 1868, George Gibbs, Esq., of Washington, D. C., read a paper upon the Physical Geography of the North-Western Territories of the United States.

On December 9, 1869, Professor J. S. Newberry, of Columbia

College, gave an account of his Explorations in Utah and Arizona Territories.

The Foreign Corresponding Secretary, Hon. Townsend Harris, and the Domestic Corresponding Secretary, W. H. H. Moore, Esq., have presented no reports of their respective departments, as it has been found covenient to have the whole correspondence of the Society temporarily conducted by the Recording Secretary, Mr. E. R. Straznicky.

The former relations of the Society with other learned and scientific bodies will soon be re-established by the transmission to them of its own Journal, as well as of other exchanges.

Although the Recording Secretary, Mr. E. R. Straznicky, has presented no formal written report of the operations of his office, the Council avail themselves of the opportunity to express their satisfaction with the systematic manner in which the records of the Society have been kept, as well as with the arrangement of the rooms, all of which are subject to his immediate supervision.

In conclusion, the Council desire to record anew their grateful sense of obligation to the public-spirited and benevolent founder of the Cooper Union, and to the Board of Trustees of that Institution, for the uniform courtesy and liberality which they have continued to display in their intercourse with the officers of this Society.

Respectfully submitted.

F. A. Conkling,
Chairman, etc.

Annual Report of the Treasurer for 1869.

American Geographical and Statistical
Society's Rooms, Cooper Institute,
New York, *January* 25, 1870.

The Treasurer respectfully submits the following report for the period from May 20, 1869, to January 25, 1870, of the receipts and expenditures of this Society:

Receipts.

Balance from last year	$843 96
Initiation fees from new members for 1868	30 00
Initiation fees " " " " 1869	450 00
Annual dues for 1867	10 00
" " " 1868	5 00
" " " 1869	105 00
Subscription to special fund for the purchase of Henry Stevens' collection of books, atlases, and maps	4,845 00
Total	$6,288 96

Expenses.

Salaries for 8 months of Clerk and Assistant	$528 00	
Books, maps, globes, and atlases	3,741 41	
Furniture	412 04	
Stationery	69 80	
Printing	270 01	
Binding	118 80	
Sundries, including postage stamps, advertising, and other expenses with meetings	574 46	
Total		$5,714 96
Leaving a balance on hand of		574 44
To this sum must be added the uncollected dues from 405 resident members for the coming year 1870, at $5 each, exclusive of life members		$2,025 00
Outstanding dues for 1869, about		200 00
Available resources for the coming year		$2,799 44

In this sum are not included the initiation fees from new members, which probably will amount to several hundred dollars.

Respectfully submitted.

HENRY CLEWS,
Treasurer.

Annual Report of the Librarian for the Year 1869.

ROOMS OF THE AMERICAN GEOGRAPHICAL AND STATISTICAL SOCIETY, COOPER INSTITUTE,
NEW YORK, *January* 25, 1870.

The Librarian respectfully presents to the members of this Society, the following report for the period commencing with the 21st day of May, 1869, and ending on the 25th day of January, 1870.

The receipt-books of the Society, in which are noted the several donations that are made to the Library, show that during the period mentioned two hundred and eighty-nine donations have been made, and of the following character:

Folios	7
Quartos	30
Octavos	54
Duodecimos	2
Pamphlets, Quartos	16
" Octavos	174
Maps	67
Total	350

The books of the Society in which are noted the various purchases which are made for the Library, show that five hundred and eighty-six entries have been made, and which comprise the following:

Folios	66
Quartos	168
Octavos	749
Duodecimos	65
Pamphlets, Octavos	6
Maps	23
Total	1,076
Total of Donations and Purchases	1,426

It will thus be observed that a large addition has been made to the valuable and useful Library of the Society since the month of May, 1869.

Among the purchases is included the large collection or rare geographical works and atlases, numbering seven hundred and sixty-one volumes, which has been purchased from Mr. Henry Stevens, with the aid of a private subscription, made for that object, amounting in the aggregate to the sum of four thousand eight hundred and forty-five dollars.

The names of the subscribers who conferred this benefit upon the Society, of owning such a valuable collection by their contributions to this fund, will appear in the forthcoming volume of the Society's Journal, which is now in press and will be issued in a few weeks.

The donations, for the most part, have been from foreign societies, with which this Society is in regular correspondence. Among the other donors to this Society are included a large number of our National, State, and Municipal officers and many private gentlemen, whose names will also appear in the forthcoming volume of said Journal.

The Librarian cannot but congratulate the Society upon the very satisfactory condition of its Library.

It has been impossible to furnish the promised catalogue, but it is confidently hoped that, during another year, means will be set apart for that purpose.

Respectfully submitted.

HENRY B. HAMMOND,
Librarian.

ANNUAL ADDRESS,

By the Hon. CHARLES P. DALY, LL.D., President,

DELIVERED JANUARY 25, 1870.

Subject: *Review of the Events of the Year, and Recent Explorations and Theories for Reaching the North Pole.*

Ladies and Gentlemen:

The year which has just closed will hereafter hold a prominent place for the important geographical and scientific events which have occurred within its limits.

1. The connecting of the North Atlantic with the Pacific Ocean by rail.

2. The completion of the canal across the Isthmus of Suez.

3. The explorations and discoveries in Southeastern and East Equatorial Africa.

4. The additional evidences brought to light of a climate in the ice-bound regions of the Arctic at a remote period of time, analogous to that of countries lying not very far from the equator.

5. The marvellous results of the deep-sea dredgings of Professors Thompson and Carpenter, revealing the existence of animal life at enormous depths in the ocean, where we should have supposed the existence of life to have been impossible.

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6. The very general disturbance throughout this year, of the earth's surface by earthquakes; distinguishable not so much for the effects in particular localities, as for the wide distribution of the phenomenon, and its appearance in parts of the world where such disturbances have not been witnessed within the memory of man.

7. The attractive power of mountains, ascertained by the pendulum experiments made at the observing stations upon the Himalayas in India.

8. The discovery, through the spectroscope, of a method of determining the proper motion of the stars, and the fact that the physical and chemical constitution of the whole stellar universe is identical.

9. The invention and practical use of a self-registering compass, by which every motion of a vessel can be recorded and preserved from the beginning to the end of her voyage.

10. The discovery of trees of enormous height and magnitude in Australia, one of which was found to be 69 feet in circumference.

11. Of great deposits of coal throughout New Zealand, and the finding of coal upon the borders of the Caspian Sea, verifying in the last particular, a prediction of Humboldt, 40 years ago. Both of which discoveries are of the highest importance to commerce.

12. The anthropological researches in Europe, Asia, and Africa, in relation to the structure, mode of life, and condition of primitive man.

13. The assembling, at Copenhagen, last August, of the International Congress of *Pre-Historic Archeology*, under the auspices of the King of Denmark, interesting in the circumstance that it brought into connection with each other learned men from all parts of Europe, and for the valuable information the papers and discussions elicited respecting three successive periods of man's progress, known as the Stone, the Bronze, and the Iron ages.

14. The return of Captain Hall from the Arctic, bringing back interesting mementoes of the Expedition of Sir John Franklin, and a more particular description of the geog-

raphy of the ice-bound region where the Captain had passed the last five years.

15. The exploration by Dr. Hayes of the remains of settlements made in the tenth century upon the south-eastern shore of Greenland, and the photographing of these long deserted habitations, and of the characteristic features of Arctic scenery by M. Bradford, the artist, with whom Dr. Hayes was associated; being an interesting addition to the previous labors of Rink, the former Governor of Greenland and now the learned archeologist of Copenhagen.

16. The return of Captain Adams and his men from the exploration of the Colorado and its tributaries, which, apart from its geographical and geological importance, is said to have embraced an inspection of the ruins of cities, abandoned mines, canals, fortifications, bastions, etc., the remains of a former people upon this continent of whom we have no knowledge.

17. The French Expedition up to the river Mekong, and westerly through the province of Hunan in China to the ancient capital of the province—one of the most remarkable journeys in the history of travels, a brief account only of which has so far been given by the surviving leader, Lieutenant Garnier.

18. The completion of the geological survey of New Jersey under Professor Cook, and the commencement of geological surveys of Ohio under Professor Newberry, of New Hampshire under Professor Hitchcock, and of Arizona and Colorado under Professor Hayden.

19. The Expedition of Sir Samuel Baker, last October, under the auspices, and with the aid, of the Egyptian Government, for the exploration of the Albert Nyanza, discovered by Baker in his memorable journey in 1864, and for establishing upon the lake steam navigation.

20. The successful passage of a Norwegian sloop, the Solid, from Hammerfest, in Norway, through the Carian Sea, the Straits of Waigatz, and along the Siberian coast to within a few miles of White Island, lying off the N. W. point of the Gulf of Obi; interesting from the fact, that this small

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vessel penetrated so far into waters hitherto regarded inaccessible, without encountering ice, or discovering any signs of it.

21. The Expedition of the Russian merchant, Sideroff, in his own steamer, the Georg, upon a voyage of exploration around the coast of Norway and through the Polar Ocean to the mouths of the Petschora, and from thence through the Straits of Waigatz, and, if possible, to the mouth of the Yenisei.

22. The Expedition of the Imperial Geographical Society of Russia, under the command of Baron Maydell, for the more complete exploration of that portion of Siberia situated in the extreme north-eastern part of Asia, near Behring Straits.

23. The return of one of the German Expeditions sent out for the discovery of the North Pole, and the sailing of another from Bremen last June, make up a hasty and imperfect catalogue of the events which distinguish the year, and denote the intellectual activity that has prevailed, and the important results which have attended it.

The completion of the Pacific Railroad has realized the dream of Jonathan Carver, the Connecticut captain, who, escaping from the bloody massacre at Fort William Henry, found his way to the waters of the Upper Mississippi, and during the three years that he dwelt among tribes previously unvisited, and while wandering over regions where the foot of a white man had never trodden before, conceived the project of establishing a settlement upon the shores of the North Pacific Ocean at some point between the 45th and 50th parallels of north latitude, and of connecting it by a road with the then infant colonies on the Atlantic, so as to bring them into direct connection with the wealth of China and the riches of India. It was, at the beginning of last year, exactly a century since he returned freighted with this idea, to find the colonies in an angry controversy with the mother country—the one exacting the recognition of their rights, and the other exacting obedience. Taking no part in the quarrel, he hastened to England to bring to her knowledge, as he said, the existence of countries which

would prove to her a more abundant source of wealth than any of her colonial possessions, and found that Government as insensible to the value of his suggestions, as they were *then* to any suggestion upon the proper management of their colonies. They took his maps and charts and kept them for five years until the war broke out, which, putting an end to his plans, he had to content himself with the publication of his travels—a work that has passed through many editions and is distinguished for the acuteness of his observation, the truthfulness of his narrative, and the comprehensive character of his mind. In that work he made the prediction, that the scheme which, he said, he had the honor of first planning and attempting, would one day be fulfilled; and the year which has just closed has witnessed its accomplishment, through an instrumentality, the rail and the locomotive, of which Carver had not the remotest conception.

The completion of the Suez Canal is the realization of another dream indulged in for 2,100 years; for there has floated down the stream of history a tradition that the project occurred to the mind of Alexander, and that he consulted his engineers, who reported against it from the difficulty of preventing the canal's filling up at its mouth, through the drifting of the sand; a difficulty still apprehended, now that it is cut and vessels have passed through it. The tradition may be true; for when Alexander achieved the bloodless conquest of Egypt, there was a canal from the Nile to the Gulf of Suez at the northern extremity of the Red Sea, eighty miles in length and forty feet deep—a work of itself sufficient to suggest to him the more important one across the Isthmus to connect the Red Sea with the Mediterranean. Herodotus says that the canal referred to was begun by Necos, an Egyptian king of the sixth century before Christ, and was finished by Darius, the Persian monarch. The difficulties of such an undertaking at that early period, and of the peril it involved, may be judged from a fact stated by Herodotus that 120,000 Egyptians, employed upon the work, lost their lives in making the excavation; a circumstance illustrating the truth of the observation of Gibbon, that the native indo-

lence of the Egyptian had to be quickened by the lash of the taskmaster. Herodotus tells us that Necos discontinued the work because the oracle had warned him that he was laboring only for the barbarian; a term, says the historian, which the Egyptians applied to all who spoke a language different from their own. Sir Gardiner Wilkinson, the eminent Egyptologist goes farther back than Herodotus, and affirms, from the evidence of monuments, now remaining upon the banks of this canal, that it was begun in the reign of Rameses II., which would be a thousand years earlier, and he supposes that what Necos undertook, and afterward abandoned, was the reopening of the old canal, which is probably the truth, as a canal exposed through such a desert to the drifting sand would, if neglected, fill up. This, in fact, subsequently occurred. A century after the visit of Alexander, Ptolemy Philadelphus, in order to command the commerce of Arabia and India by means of this canal, which had filled up, caused it to be excavated, and founded at its eastern outlet the city of Arsinoë, at or very near the present site of Suez. Again this work fell into neglect, and remained buried in the drifting sand until the seventh century of our era. The memory of the Caliph Omar is perpetuated in the indignation of scholars for having ordered the destruction of the Alexandrian Library, with the treasures it is assumed to have contained of the learning, the arts, and the science of antiquity. Whether he was or was not the author of this act of vandalism—a point upon which historical critics have differed, there is one thing respecting him at least worthy of remembrance, which is, that he signalized his conquest of Egypt in the seventh century by devoting one-third of the tribute to the repair and restoration of her canals, and among them the canal of which we are speaking. He caused the sand to be removed; and it was used for the purpose of navigation, it is said, for 134 years; to be again filled up by the orders of another Caliph, to prevent supplies reaching his enemies, and was afterwards so forgotten, and completely lost, as to make it a matter of dispute whether it had ever existed. In the sixteenth century the

project of a canal from Pelusium, on the Mediterranean, to Suez, was conceived by one of the Turkish Sultans, who took possession of the Isthmus for the purpose; but the commencement of the work was arrested by his death. This great project was again revived by the first Napoleon, who ordered a survey to be made, when the remains of the long buried canal between the Nile and the Red Sea were discovered; but the perilous position in which the First Consul was soon afterwards placed, and the necessity of his departure from Egypt, put an end to whatever scheme he may have meditated. To all this should be added the popular error which prevailed from the time of Pliny, and probably before it, that the Mediterranean was thirteen feet higher than the Red Sea, and that there would be a strong current through the canal in one direction only. The year the events of which we are reviewing witnessed the completion of this long cherished project, and mainly through the energy of a single individual, M. Lesseps, who has hitherto overcome every difficulty—the raising of the vast sum expended upon the work, the secret or open hostility of governments whose interests were assumed to be opposed to it, and the cutting of it through a bed of sand, which, moving and flowing like the waves of the ocean, has buried cities and converted into deserts what were once populous districts. It must yet, it is true, be regarded as an experiment; but where so much has been accomplished and so many predictions of impossibilities have failed of fulfilment, it may be well for those who are so ready to hazard the opinion of its ultimate inutility, to wait until time and experience have settled the question. In this country, and especially in this Society, it has been watched with the deepest interest in every stage of its progress, and the fullest confidence has been felt in its final success. The apprehensions felt, especially by English writers, are from the effects which may be produced by the deposit of sand and mud, which is brought down in prodigious quantities by the Nile, and drifted eastward as far as Syria, so that places which lay along the shore when Strabo wrote, are now six miles inland. This, they urge, will penetrate

through the interstices of the stone piers that stretch out into the Mediterranean and constitute the entrance to the canal, and have their doubts whether these great forces of reaction may not prove too much for the power of man to overcome, or in overcoming them involve an expense too great for the profits of the work to bear. When it is remembered what has been already effected by the dredging machines in the excavation of the canal—machines in themselves a triumph of engineering skill in their wonderful adaptation to the extraordinary work they have accomplished, there is, I apprehend, little reason to fear that there will be any great difficulty, or any very heavy expense, in keeping the mouth of the canal permanently open. Then, again, our attention is drawn to the difficulty of ships, with heavy freights, navigating the Red Sea safely and profitably. The Red Sea is certainly one of the most perilous of waters, from the rocky islets scattered in all parts of it, and from coral banks, more numerous and extensive than in any body of water of equal extent in the world, lying close to the surface without any indication in the wave above of the peril beneath—perils poetically expressed by the Arabic name of the straits at the entrance of the sea, *Babel Mandeb, the gate of tears.* But, however formidable this may have been for ships depending solely upon the agency of the winds and currents, and for the primitive vessels manned by Arabs, which have hitherto chiefly traversed this sea, it does not present the like difficulty for steamers, and the time is not far distant when steam will be in as general use for the purpose of transportation upon the ocean, as it is now upon the land.

If this new gateway for commerce should prove successful, as I think it will, then it will have reduced the carriage by water between England and India from the 15,000 miles which it is now, to about one-half the distance, or 8,000 miles; and we may see a revolution in the transportation of the products of the world as great as that which was created at the close of the fifteenth century by the discovery of the passage by the way of the Cape of Good Hope. It will bring back the Mediterranean to its ancient position as the

great highway of the maritime commerce between Europe and Asia, and restore to the nations and cities upon its borders something of their ancient importance.

The explorations in South-eastern Africa have resulted in the discovery of gold fields, bearing evidence that they were worked at a former period, and the situation of which has led Sir Roderick Murchison, upon well-considered reasons, to the conclusion that this spot, the region of the Limpopo and its branches, was the long-lost *Ophir* of the Bible. Interesting as this may be, and important as the result may prove of a large immigration thither in pursuit of gold, it is of less value than the fact that there lies to the north of these gold fields, a fertile region of large extent, which is said to be the healthiest yet discovered in Africa, and to be well adapted for cultivation and settlement.

Among the other interesting facts of the year in relation to Africa, is the receipt of an official communication from Dr. Livingstone, under his own hand, putting at rest all questions as to his safety, and showing that he is actively engaged in exploring the country lying southward and westward of Lake Tanganyika, discovered by Burton and Speke, and that he has found, as he thinks, between the 10th and 12th degrees S. lat., the elevated land which constitutes the southern limit of the basin of the Nile, and that the springs and sources of that interesting river rise 400 miles south of Lake Ukerwerke, discovered by Speke; or in very nearly the same position laid down by Ptolemy 1650 years ago. It will be remembered that at our anniversary meeting, two years ago, I stated that, from an examination of the early maps in our own Collection, and from the investigations which I had otherwise made, I was convinced that the lakes visited by Speke and Baker were not discoveries. That they were known to mediæval cosmographers and geographers, and represented upon maps as early as the tenth and as late as the seventeenth century. That from a comparison of the maps and an examination of the accounts to be found in the works of old geographers, to which I then referred, I was inclined to believe that the sources of

the Nile would be ultimately traced farther south, and that Ptolemy and the Arabian geographers might turn out to be nearer the truth than had hitherto been imagined.

If Dr. Livingstone is right in his supposed discovery, then this river, the seat of the oldest civilization with which we are acquainted, will, in addition to its historical interest, prove to be the longest river in the world; and whether he is destined to be the discoverer of the final sources of it or not, there are details enough in his letter to show that he will have contributed largely to our knowledge of the geography of this comparatively unknown part of Africa, and will hold the rank in all future time of one of the most successful if not the greatest of African explorers.

We have also the statement that an Italian, Carlo Piaggia, who has been wandering for some years in the regions west of the White Nile, has sent home the intelligence that there is another great lake lying west of the Albert Nyanza of Baker, which he could not reach, but the approximate position of which he was able to fix upon the unanimous testimony of the natives and Dr. Peterman of Gotha upon the information received, places this lake about 130 miles west of the Albert Nyanza of Baker,—a little to the south of the lake. I would add that upon some of the old maps a large lake is represented in about that locality as connected with the Nile, and also as the source of a great river running into the Atlantic, for instance in the Arabic maps of Magrebinus, 1274, and of Abulfedae, 1331; the Mappa Mundi of Mauro, 1459, and some others. I should also state that a telegraphic despatch, I have been informed, has appeared in the newspapers indicating that Dr. Livingstone, having failed to connect the streams and lakes he has been examining with the Nile, is now moving westward in the direction of the lake which this Italian traveller has heard of, which may possibly prove to be simply the western prolongation of the Albert Nyanza of Baker. To these new matters respecting Africa, may be added the discovery of the mouth of the Limpopo river by Mr. St. Vincent Erskine, of Natal, who has discovered the previously unknown lower course of this fine

river to its embouchure in the Indian Ocean; and the Expedition of Captain Faulkner and his party up the Shire river and for the navigation of Lake Nyassa, which failed of success from the setting in of the rainy season.

The facts brought to light during the past year upon the subject of the antiquity of man are of an exceedingly interesting character. Among those of especial importance is the discovery in two small islands—Santorin and Therasia—in that part of the Grecian Archipelago known as the Cyclades, of the remains of villages or towns one hundred feet beneath an overlying strata of pumice stone and tufa, which, as in the case of Pompeii, had fallen suddenly upon them during the eruption of a volcano, and has so completely buried them for probably thousands of years, that vineyards, producing a wine much esteemed and exported to England, was growing luxuriantly upon the surface, beneath which lay the remains of this lost and long-forgotten people. The discovery was made in procuring blocks of tufa for use in the construction of the Suez Canal, and it is of the deepest interest, as all that has been discovered shows that these people lived during what geologists call the quaternary period of the tertiary, and anthropologists denominate the Stone Age, before the use of metals was known; underlying all that we know of Grecian civilization; before Homer sung, or any of those names which Grecian literature has made immortal had played their part in the world's history. As was the case in Pompeii, we are brought to the people as they were when this sudden calamity overwhelmed them; the barley which they ate heaped up against the walls, the tools they used lying in their places, jars filled with pease and annise, cardamom, etc., and other kinds of pottery tastefully ornamented, troughs for the feeding of their animals, vessels for the pressing of oil, slabs of stone between which the corn was ground by hand, or as the archeologists call them, hand mills, stone disks with a hole in the centre, and a groove such as are still in use in the country by weavers for stretching the threads of the warp, flint arrow heads, lance heads, and flint saws; but no trace of metals, not even a nail in the wood-work of the roof, and one

human skeleton only, that of a man, the sole representative of the inhabitants who dwelt there, which was found doubled up in a corner of a room as if he had been crushed by the falling of the roof. The details discovered show that this early people had made considerable advance in civilization; that they cultivated various kinds of grain, had domesticated animals, that they grew olives and pressed oil, that they imported products not of their own island by sea, and notwithstanding their imperfect tools of flint and stone, that they had skill as carpenters and masons, as they constructed houses in part of stone and of wood divided into chambers, and which must have been tolerably comfortable.

This is an interesting addition to the lake dwellings, the charred remains of which, it will be remembered, were first found some few years ago on the borders of the Swiss lakes, upon the receding of the waters in a season of great drought, and have since been discovered elsewhere in Prussia, Bavaria, Northern Italy, and the Danubian Principalities, some of them during the past year.

Flint implements, such as arrow heads, lance heads, and saws, and stone axes, and other tools and weapons of stone, belonging to an age and people before the use of metal was known, it will be remembered, have been found in all parts of Europe and in this country, especially within the past quarter of a century. They furnished the basis for the belief in the existence formerly, throughout the world, of a period known as the Stone Age. These discoveries, however, extending no farther than Europe and America, justified such a conclusion only in respet to the parts of the world where the evidence was found. There remained the older civilizations of Asia and North-eastern Africa, and unless some evidence was discovered in these early seats of civilized man, no general conclusion could be indulged in, that there was, originally, a Stone Age in every part of the world.

This evidence has now in part come to light. Egypt is the oldest civilization of which we have any knowledge, and it is interesting to communicate that during the past year, Marriette Bey, the French explorer, has, it is reported, found in

Egypt, underlying the civilization of the temples and the pyramids, flint and stone implements of the same general character as those which were previously found in Europe and America, belonging to a rude and primitive people, who dwelt in the land before these structures were erected; and similar discoveries have been made in Asia Minor, especially in Palestine, and also in Central India and in Japan.

My limits will not permit me to go over in detail the mass of material accumulated within the year upon this interesting subject of the antiquity of man. I can only refer to the exploration of the hitherto unknown caverns lying around and below the Rock of Gibraltar, where vast deposits of human remains have been found in upper chambers, evidently used, in a long past age, as sepulchres, by a people of low stature and meagre muscular development, but by no means of a low intellectual type, and with them finely-polished axes and knives of stone, fish-hooks of bone and rude pottery; together with the remains of sheep, oxen, birds and fishes; and in the older chambers below, where no traces of man have been found, the remains of many animals now extinct, and of the elephant, the wild horse, the rhinoceros, the ibex, the African leopard, the badger, the fox, the rabbit and the rat; with the evidence, in the shattered condition of the strata, to indicate that this rock was once joined to the African coast, and rent by a great subterranean movement, which opened the present straits or water channel, and changed the Mediterranean from a lake into a sea, at the very time, in all probability, when these animals, whose sepulchres are below, were living upon the rock or in its vicinity. The exploration, during the past year, of extensive caves in Sicily and in Portugal, filled with the remains of animals and men—cave dwellers—who, there is every reason to believe from the indications, were, like some of the present inhabitants of Africa, cannibals. But the details of discoveries of this nature are too many to enumerate, and I must stop here, with the general observation, that the evidence gathered during the year confirms what was previously supposed, that man certainly lived in the period known to geologists as the deluvium, and probably in the tertiary.

The deep-sea dredgings of the past year have told a tale that will revolutionize some of the conclusions of the geologist and disturb the order or arrangement of the naturalist. Animals, the remains of which the geologist has found in fossiliferous rocks, belonging to a species supposed to have been extinct for thousands of years, are now found living at great depths at the bottom of the sea, as actively engaged beneath the waters as their ancestors were, whose sepulchres are on the land, in the composition of rocks, which are to be their resting-place and the record of their life and labors, if these rocks should hereafter be lifted up and become a part of the land. It has been a settled conclusion of the geologist that the chalk and the sandstone were formed beneath the sea at different geological periods; but these dredgings show that in places at the bottom of the sea, not ten miles apart, both the chalk and the sandstone are now actually in the process of formation. This, with the facts that there are not, as has been supposed, zones of temperature beneath the ocean, and that at the enormous depth of three miles, where the cold is intense, where no light could be supposed to penetrate, and where the pressure is three tons to the square inch, animals are living, that have eyes, are among the contributions which the year 1869 has added to the stock of human knowledge.

There has been, since the year 1858, eight Polar expeditions fitted out either with the view of reaching the North Pole, or of collecting information respecting the geology, paleontology, physical geography, and natural history of the Polar basin.

In 1857, a Swedish expedition was fitted out at the expense of Captain Otto Torrell. It visited the western coast of Spitzbergen, reached to 80° 40′ in N. L., and brought home a valuable zoological and geological collection.

In 1861, another Swedish expedition was sent at the public expense, consisting of two vessels, which were put in charge of Captain Torrell, with a corps of scientific men. The north and west coasts of Spitzbergen were visited, and extensive journeys made in boats to perfect the maps and study the geology of these islands, and the expedition brought back a

vast collection of materials for studying their fauna, flora, and geology. It reached 80° 30′ N. L. by ship and 80° 45′ by a land journey.

In 1864, another Swedish expedition was sent with a scientific corps at the public expense, chiefly for the important geographical purpose of measuring an arc of the meridian. It visited the southern shores of Spitzbergen, completed the survey for the measurement, and, like the former, brought back a rich geological, zoological, and botanical collection. In this expedition the snow-covered peaks of Gillis Land, lying to the north and east of Spitzbergen, were distinctly seen, confirming the existence of this high northern land, which was first seen by Cornelius Gillis, a Dutch sea captain, in 1707, in about 80° N. lat., 30° E. long., but had never been observed afterwards until this Swedish expedition, and has not yet been reached.

The next expedition was that of the Germania, in 1868, sent out under the auspices and at the expense of the distinguished German geographer and cartographer, Dr. Peterman, of Gotha, for the discovery of the Pole, and which attained a high point then for a vessel, 81° 5′ in N. L.; the farthest ever reached being by Perry, in 1827, 82° 40′ N. L.; not, however, in a ship, but in a sledge-boat, over the ice.

The Germania first reached to 80° 30′ N. lat. and 6° 35′ W. long., where the ice was lying in heavy peaks. She then steered south down to 79° 30′ N. lat., where she was entangled in the ice, and sailed along the edge of the pack going back to 74° 30′ N. lat.; when an attempt was made to reach the coast of Greenland, but on attaining 14° W. long. they found an impenetrable barrier of ice-fields. A third attempt brought them to 17° 30′ W. long., 73° 23′ N. lat. They then directed their course to the N. E. coast of Spitzbergen to endeavor to force their way through Henlopen Straits and reach Gillis Land. In this effort they got farther to the east than the Swedish Expedition of 1864, when they saw to the east the ice extended in one vast unbroken mass to Gillis Land, which was plainly visible through the telescope from the deck of the Germania. They found around Cape Torrell immense

quantities of drift wood piled up upon the coast 20 feet high, denoting the activity of the current in this quarter. They waited until the 10th of September for the breaking up of the ice, but in vain, and upon getting clear of the land they went to the north 81° 5′ N. lat., 16° E. long.; when their further progress north was barred by packs of ice in every direction.

The next is the Swedish Expedition of 1868, under Captain Nordenskiöld and a large scientific corps. They directed their course to the coast of Spitzbergen. In August they anchored at Amsterdam Island, and from thence they attempted to penetrate along the 80° N. lat., but were met by impassable barriers of drift ice. They then turned their course north, and, after innumerable zigzags, attained to 81° 16′ N. lat., but could make no further progress, the ice northward being impassable; and they found their way out in a south-easterly direction. They afterwards made an attempt to reach Gillis Land, but found it impossible, and again sailed northward from the Seven Islands, and after a number of zigzags through the drift ice they got in longitude 17° 30′ E. to 81° 42′ N. lat., supposed by them to be the highest northern latitude ever attained; in which, however, they were in error, for *Scoresby*, in 1806, reached in a whaler, in a favorable season, to 81° 30′ N. lat. in 19° E. long., with an open sea still before him to the north, as far as the eye could reach; and in 1837, the *True Love*, of Hull, upon the report of Whitworth, her surgeon, reached to 82° 30′ N. lat., 12° 15′ E. long., and found the sea still open to the north-east, without any obstacle to prevent her further progress. At the point, 81° 42′, reached by this Swedish expedition, the ice lay in vast masses, and on their way they met with ice black with stones, gravel and earth, indicating the existence of land still further north; a fact to which several eminent English Arctic navigators attach great importance, as affording a hopeful indication of being able to reach the Pole, in this direction, by means of the land. This expedition not only made a vigorous attempt to get to the Pole, but surpassed many others in its geographical and scientific achievements. During their cruising

amid the drift ice, between 80° and 82° N. lat., they sounded continually with what is known as the "Bull Dog" apparatus, with most important results, not only in regard to the ocean's depth in this part of it, but also in respect to Arctic animal life at great depths. They found that Spitzbergen is not separated from Norway by a very deep channel; that it is only 300 fathoms, whilst it is more than 2,000 fathoms deep to the north and west of Spitzbergen. They obtained specimens of animal life at a depth of 2,600 fathoms, and brought back an immense collection of plants and petrifactions.

The next is the German Expedition, in the Albert, last year, 1869. The Albert crossed Barentz Sea at 76 N. lat. from the southern shores of Spitzbergen to the northern coast of Nova Zembla, and reached the farthest point in her voyage, 80° 14′ N. lat., 90° 52′ E. long, where, in the month of June, the ice presented an impassable barrier, so as to prevent her proposed visit to Gillis Land. She then went to the western coast of Spitzbergen, where another attempt was made to reach Gillis Land, but without success. In this voyage a number of meteorological observations were made, the geography of several parts of the Arctic was corrected, and a collection of specimens was secured by dredging.

On the 22d of February, 1869, Captain Hagens sailed from Bremen in a screw steamer, the Bienenkorp, to Jan Meyens Island, for the purpose of seal hunting, and then to attempt to sail north as far as possible, in the months of June and July; but what has been the result, I have not learned.

The last is the Expedition of Mr. Lamont, of Glasgow, a member of the Royal Geographical Society, at his own expense, in his own vessel, the Diana; and though they reached Nova Zembla in May, and Spitzbergen in June, and the vessel was commanded by an experienced Norwegian navigator, they failed to get beyond the 80th parallel N. lat., the season being unfavorable; and there are now three expeditions there to hear from, and the French Expedition, which has been so long in preparation, of M. G. Lambert, which is to attempt to reach the Pole by the way of Behring Straits.

This makes, as I compute it, about 113 expeditions, from the first under Sir Hugh Willoughby, in 1553, to the present year, which have been specifically sent out either to find a North-East or a North-West Passage, or to reach the Pole, or to rescue previous expeditions, or obtain scientific information, the details of which fill nearly 1,000 volumes.

Attempts have been made to reach the Pole by sailing north between Greenland and Spitzbergen, between Spitzbergen and Nova Zembla, by the way of Smith Sound, the route of Drs. Kane and Hayes, and through Behring Straits to the north, the north-east, and the north-west; but no vessel appears, upon any reliable information, to have got much further than the 82d parallel. There have been many theories as to the way to reach the Pole, and I will refer to one of the last, as it was first presented to this Society, and because the review of it will, to a great extent, bring under consideration the whole subject.

In 1868, Captain Bent, the flag officer of Perry's Expedition to Japan, and who was afterward engaged in hydrographic labors under Capt. Maury, at Washington, addressed me two letters as President of the Society, submitting for its consideration his theory for reaching the North Pole, by following the great currents that run northwardly in the Atlantic and in the Pacific, in which his views, founded upon hydrographical reasons, were set forth with great clearness, and, I may add, with great modesty. I placed the two letters in the hands of Dr. Hayes, the most competent member of the Society, to give an opinion upon the value of Capt. Bent's hypothesis. He was not much impressed by it; and in a paper which the Doctor shortly afterward read before the Society, he, in very courteous terms, referred to the theory of Capt. Bent, with the remark that the route suggested by him, and which the Captain supposes to be the course of the Gulf Stream through the Arctic, had hitherto proved to be one of the most impracticable. He thought more favorably of Capt. Bent's suggestion of following the course of the current N. E. through Behring Straits, but expressed his own preference for the route through Smith

Sound, which Dr. Kane and himself had followed, with the important result of finding open water. Capt. Bent afterwards, in a lecture at St. Louis, reviewed the objections of Dr. Hayes at some length, with the observation that the Doctor had "failed to see the point and gist of the theory," being "wedded to his own dogmas"—I use Capt. Bent's language—"in face of the thousands of lives, the millions of money, and the three hundred years of time that have been wasted in attempts to reach the Pole," in neglect or ignorance of the way, which Capt. Bent thinks he has discovered, of finding it. I afterwards examined the theory myself, and, coming to the conclusion that experience of the past was not favorable to it, I, as Capt. Bent had requested, read his two communications to the Society at one of its meetings last year, without giving any expression to my own opinion, and where the theory was received with some observations on the part of the members which could not be considered as either favorable or unfavorable. As it failed to impress those in the Society who had especially examined it, and as public attention has since been earnestly called to it, not only by Capt. Bent himself, but in a popular magazine in this city with the statement—I quote the language—"that there is reason to believe that the perilous question of the way to the Pole has at last been answered; that a great mind has successfully *bridged* the polar *chasm*, and furnished a true *chart* and a true *compass* with which to reach the Pole in safety." I propose, in behalf of the Society, and in the general interest of geographical science in this country, to examine calmly what foundation there is for so confident an assumption.

I do not propose to examine the deductions which Capt. Bent has drawn from what is known respecting the laws of oceanic currents, for several reasons: 1. Because our knowledge of these laws is as yet imperfect. 2. Because the deductions drawn by him are in their nature speculative, or, as he says, "purely hypothetical," and the precise weight or value to be attached to them in their bearing upon such an inquiry should be left to those who have made hydrographi-

cal studies a specialty; and *lastly*, because, in the absence of a series of thermometric observations of the sea surface, I attach very little value to any such broad and general conclusions, however plausible or attractive they may appear; being of the opinion of that experienced Arctic navigator and writer, Captain Sherard Osborne, that what is wanted now upon the subject of Polar exploration are, facts and not theories. We have had a striking illustration during the past year of the little value to be attached to theories, or rather of the effect of relying upon them. About a century ago, Forbes, the naturalist, as the result of his observations, came to the conclusion that there was a succession of natural zones of marine life in the ocean, which became more sterile in organism as we went down, until a zone was reached, at or about the depth of 300 fathoms, containing little or no trace of animal life. It is due to this distinguished naturalist to say that he presented it simply as a suggestion, and urged the necessity of dredging farther down into the depths of the ocean; but he died, and, without any further investigation, his theory was eagerly grasped at and accepted by men of science, because it afforded a simple and rational explanation of various phenomena which had long remained enigmas to paleontologists and geologists, and it maintained its ground to a certain extent until last year, when the facts brought to light, in the dredgings to which I have referred, showed it to be entirely unfounded. To which may be added the theory of a northwest passage for vessels to Asia, which, reasoning from geographical analogy, appeared so exceedingly probable that it was long universally believed in. I propose therefore to examine Captain Bent's theory by the test of the facts which have been supplied by past experience.

I may remark in the outset, that this theory necessarily assumes as a fact, the existence of an open polar sea, and that the theory is relied upon in support of the existence of such a sea, and as explanatory of the cause of it. This is a very old belief. It has been believed in for more than two centuries. It is supposed to have been first suggested by Hendrik

Hudson;* but the form and shape even, of this supposed sea is to be found engraven in *Matthew Quad's Fasciculus*, published at Cologne in 1608—a work to be found upon the shelves of our Library, where it is gravely represented with four rivers running from it, to the north, the east, the west, and the south, and yet its existence is as uncertain now as it was when this engraving was printed. The only evidence in support of it is the fact that open water of considerable extent has been seen by Hedenstroem and Wrangell, north-east of Behring Straits; by Morton, of Kane's Expedition, and afterwards by Dr. Hayes, in Kennedy's Channel, and by Capt. Penny in Wellington Channel; but it by no means follows from this that what was seen was a sea, or the affluent of one. The most experienced Arctic navigators are divided in opinion upon the question. Capt. Hamilton, during the last year, read a paper before the Royal Geographical Society, to show that the facts which Capt. Maury adduced in support of the existence of such a sea, are, as facts, totally without foundation; in which, I think, all will agree who have read Capt. Hamilton's modest and very able paper. In the discussion which followed the reading of it, Sir Edward Belcher adhered to his former opinion that such a sea existed, of which opinion also was Capt. Inglefield; whilst Sir Leopold McClintock and Capt. Sherard Osborne, certainly two very competent critics, differed from Sir Edward and agreed with Capt. Hamilton, that the theory of an open polar sea had broken down. Capt. McClintock said that those open water spaces could be readily accounted for by strong currents and tides. That they were solely due to the action of the tides sweeping away the ice as fast as it was formed, and were common all along the coast of Greenland, and were known to the Esquimaux, and that nothing that had been seen of late years warranted the belief of the existence of a warmer climate to the north. So that this question must be regarded as too unsettled and uncertain to be accepted as a fact in connection with the theory of Capt. Bent.

* *Henry Hudson in Holland, p. 27, note by Hon. Henry C. Murphy. The Hague*, 1859.

Capt. Bent's theory is this: That the Gulf Stream of the Atlantic, and the warm Japanese current of the Pacific, are each prolonged to the vicinity of the Pole; where he thinks these currents unite, and, discharging their heat, produce an open polar sea. He is of the opinion that these currents are the prime and only cause of the existence of this sea, and that they constitute the only practicable avenues by which ships can reach it or the Pole; or, to use his own language, the way to the Pole is by following the course of these currents, which are water thermometers, and may be termed the *thermometric gateways to the Pole.*

In consonance with this theory, he assumes that the northerly branch of the Gulf Stream extends around the coast of Norway, and runs from thence eastward of Spitzbergen, to the Pole, and that the Japanese current, or *Kuro-Siwo*, is prolonged through Behring Straits, in a north-eastwardly direction, until it encounters and mixes with the other in the vicinity of the Pole. There is a powerful current running in a north-easterly direction through Behring Staits, known on the maps as the Kamtschatka current, which he concludes is a prolongation of that upon the coast of Japan, and in which he may possibly be right.

Mr. T. B. Maury, the writer of an elaborate article in "Putnam's Magazine," in support of this theory, goes farther, and, in the rough map which is printed with the article, lays down the northerly branch of the Gulf Stream as running along the coast of Norway, eastwardly, to Nova Zembla, and as deflected from there in a northerly direction, and eastward of Spitzbergen, to the Pole. As authority for this he relies upon a passage in the work of our former associate, the late Dr. Kane, who says: "The Gulf Stream, already traced to Nova Zembla is deflected by that *peninsula*, into the space around the Pole." Dr. Kane does not state by whom, or where, this stream was traced to Nova Zembla; and how little the Doctor did or could know of the direction of currents in that quarter of the Arctic, is apparent at once from this very extract, in which he supposes Nova Zembla to be a *peninsula.*

The fact is, that we have no positive information as to the course of the Gulf Stream beyond the coast of Norway. In the best and most recent atlases, such as Johnston's Physical Atlas, last edition; the Royal Atlas, of 1860, by the same author; the Atlas of the Geographical Institute of Weimar, 1868, and Kiepert's (Stieler's) Atlas, which has just been completed in Gotha, there is no agreement respecting it. In the first named of these works, Johnston's Physical Atlas, its course is represented differently upon different maps.*

The fact that drift wood was found, together with vegetable productions of the West Indies, upon the N. W. shore of Spitzbergen, as high as 80° N. L., by the Swedish expeditions of 1861 and 1868, indicates that it reaches that far, but, as the officers of the last expedition in their report say, "in a greatly weakened state," and the circumstance that bottles, thrown overboard in the West Indies, have been found upon the coast of Norway, together with the fact that there is a slow current along that coast as far as the fiord or bay of Varanger, which keeps the navigation open for that distance throughout the year, would indicate also that an easterly branch of it runs along that coast; but if it were continued from there to Cape Kanin, and from thence to Nova Zembla, and northerly, as it is represented in Kiepert's Atlas of 1869, we would naturally expect to see its effects in ameliorating the climate of that inhospitable shore, and that Nova Zembla would not be, as it is, so bleak and desolate as to be incapable of maintaining even a permanent savage population.

As the movement of the Gulf Stream is due to the diurnal motion of the globe, it necessarily diminishes gradually both

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* In the text, page 16, it is said to flow in a north-easterly direction, passing Norway and Spitzbergen, to its outlet in the Arctic Sea, and in the map of the Ocean Currents, page 47, it is pictured as flowing to the southern extremity of Spitzbergen; while in the map of the Polar Basin, upon the contrary, it is represented as running to and along the north-eastern course of Nova Zembla, and from thence following in a circuitous course around the Polar Basin and the northern part of Russia, to a point about opposite Behring Straits.

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in volume and velocity as it runs northward. The contrast is very great between the same current off the coast of Florida and when it approaches Newfoundland. In passing to the high latitudes of the Arctic seas it is so reduced and weakened, that Admiral Irminger, of the Danish navy, in 1853, between 61° and 63° north latitude, and 14° 18′ west longitude, found that it ran during an observation of twenty days, only at the rate of 3.1 nautical miles per day, whilst at the end of the Gulf of Florida, in the parallel of Cape Canaveral, according to Johnston's Physical Atlas, it is said to run sometimes at the rate of five miles an hour, or 120 miles a day; which is, perhaps, an exaggerated statement.

With the view of ascertaining what we really know respecting the velocity and course of the Gulf Stream, I applied to one of the oldest members of the Society, G. W. Blunt, Esq., whom, as the head of the well-known house that has for nearly a century prepared and published the charts that have guided the American mariner in every quarter of the globe, I considered the most competent person with whom I was acquainted, to furnish the information. I submit his reply.*

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* G. W. Blunt's Letter.

New York, *December* 22, 1869.

Chief-Justice Daly.

My dear Sir,—I send you my *North Atlantic Memoir*, which contains all the accurate information (I am sorry to say, not a great deal) about that much misrepresented current of the ocean, the Gulf Stream, which body has to bear with the inventions of Maury, the stupidities of weather predictors, and the assumptions of meteorologists—enough, either of them, to crush out the vitality of any thing which had not so perfect an organization as the Gulf Stream has.

The only accurate observations we have of the Gulf Stream are those of the U. S. Coast Survey, directed by Professor A. D. Bache. He shows that the velocity of the stream was, off Cape Canaveral, about three nautical miles; Cape Fear, about two nautical miles, and off Sandy Hook (New York), one nautical mile; that is, the stream was divided into three sections, named as above. These sections comprise a space from lat. 28° to lat. 40°, from long. 80° to long. 66°, being 720 miles of latitude, and 840 miles in extent. *In that distance the stream diminished its velocity two-thirds.*.

The only observations I know of to be relied upon beyond the above quoted, is this. In June, 1853, two ships came in contact, and both went down. The

With its velocity so diminished and weakened as it is found to be by observation in the Arctic, is it reasonable to suppose that it has still sufficient force to carry it to the Pole? and should it extend so far, how small must be its influence upon the temperature and climate of the Polar basin, embracing as it does a million and a half of square miles.

It may be further remarked that if this warm ocean river

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foremast of one, the *Trade Wind*, was fallen in with, and there was a man on it, who was taken off. The mast had drifted 72 miles on a course E. N. E. nearly (true) in 101 hours, making nearly $\frac{72}{100}$ of a knot per hour. He was picked up in lat. 42° N., long. 55° 30′ W., thus showing a steady diminution of the velocity of the Gulf Stream current.

To the eastward of the above longitude nothing is known. At the Western Islands, lat. 39°, long. 28°, the set is easterly about 10 miles per day. This is, I think, due to the prevalence of the westerly winds.

In the article on "Ice," page 15, you will see that an iceberg was seen in lat. 36° 10′ N., long. 39° W., showing it had been set there by the Polar and Gulf Stream currents; but the rate of its set is not known.

Beyond the Western Islands, I believe that the Gulf Stream has no existence, and that the alleged effects of it on the climate of the British Islands are due to the assertions of the class I have spoken of in the first paragraph of my letter.

The temperature of the stream you will find I have written about in the "Memoir" which accompanies this letter. You will, I think, find this Memoir interesting, if not fanciful, too frequently the case with writers on hydrography.

The Gulf Stream as a current, I believe, entirely ceases and loses all its equatorial heat to the eastward of the longitude of 40°; the set to the east is that of the general set of the N. Atlantic, and the temperature of the water is that of the general temperature in those regions.

Of the effect of the temperature of the Gulf Stream at any distance from it, I think it but small, as the mass of atmosphere of the Gulf Stream bears a very small proportion to the atmosphere around it, which would soon equalize its temperature.

There are, in my opinion, two very erroneous ideas of the Gulf Stream, of which I will speak. The first is as to the effect of the Gulf Stream on the climate of Newport; that it softens it. The nearest point of the Gulf Stream to Newport is 155 miles, the prevalent winds are westerly, and how temperature is, in sailor phrase, beat to windward that distance, I do not know. It is 45 miles nearer Nantucket, and only 35 miles farther from Boston, where an easterly wind of a summer's day gives you the shivers.

The Sargasso Sea is the other erroneous idea to which I refer. I have a chart before me, where it is laid down very like the marshes where I used to shoot snipe upon. This does not exist. I give the language of Lieutenant Walsh,

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pursues its way through the regions of the Arctic, maintaining an open passage between Spitzbergen and Nova Zembla to the Pole, it is very extraordinary that none of the vessels that for the last three hundred years have tried to sail northward and eastward in this direction have ever been able to meet with it, but have always been compelled to put back before impassable ice. [Is it to be supposed that the many able and experienced seamen who have been thus baffled in this very

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U. S. N., page 31 Atlantic Memoir, who was sent by the Navy Department to examine the dangers of the North Atlantic.

We saw very little Gulf or sea weed in it, but much on its outer edge. While mentioning this weed I may here remark, that we looked in vain in the region assigned to the Sargasso Sea for the great fields of it which had been reported. Small patches of five or six feet, generally arranged in long parallel lines in the direction of the wind, were seen daily in crossing the Atlantic till we reached the longitude of 28°, when it disappeared altogether.

My frequent examinations of this weed satisfy me that, wherever it may originally come from, it feeds and grows upon the waters of the sea, which is certainly not more strange than the plant which feeds upon the air.

This weed grows upon the Andros Islands, which are on the eastern edge of the Bahama Bank.

Washington Irving, in his life of Columbus, says :

"On the following day there was either a profound calm or light winds from the south-west. The sea, as far as the eye could reach was covered with weeds ; a phenomenon often observed in this part of the ocean, which has sometimes the appearance of a vast inundated meadow. This has been attributed to immense quantities of submarine plants, which grow at the bottom of the sea until ripe, when they are detached by the motion of the waves and currents and rise to the surface.*

"These fields of weeds were first regarded with great satisfaction; but at length they became, in many places, so dense and matted as in some degree to impede the sailing of the ships, which must have been under very little headway. The crews now called to mind some tale about the frozen ocean, where ships were said to be sometimes fixed immovable.

"They endeavored, therefore, to avoid as much as possible these floating masses lest some disaster of the kind might happen to themselves."

In the journal of Columbus, prepared by the Spanish hydrographer, Navarette, there is no account of any large quantity of weed seen by Columbus — which he would certainly have entered had he seen it, as he mentions to us very trivial matters in the journal.

In the "Nautical Magazine" of 1859, there is an article on the Temperature of the Sea around the Coast of Scotland, by James Stark, M. D., which dis-

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* Humboldt, Personal Narrative, Book I., Chap. 1.

region, would have been insensible to the value and importance of a current running steadily to the north, or north-east, if such an one was to be seen, or fail to notice the surface indications of it, or its influence upon the calculations of their reckoning?

The German Expedition of 1869, as I have already stated, found piles of drift wood twenty feet high upon the S. E. shore of Spitzbergen. Capt. Torrell in 1861 picked up a well-known bean at Shoal Point, that had found its way from the Gulf of Mexico, and the Swedish explorers of 1868 say, "during our cruisings amid the ice, we collected a number of pieces of drift wood and glass balls, of the kind used as floats, in the Loffsden fisheries;" showing that these Arctic seas are not without these surface indications which serve as a guide to the mariner of the course of currents. It was in this very region, between Spitzbergen and Nova Zembla, that Sir Hugh Willoughby attempted to reach India in

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cusses the whole subject of North Atlantic temperatures and currents. I think it refutes Captain Bent's theory entirely.

Yours truly,

GEORGE W. BLUNT.*

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* Having been informed, since the delivery of the address, that the exact velocity of the Gulf Stream, as it passes around the coast of Florida, has been recently accurately ascertained by the United States Coast Survey, I addressed a note to Professor Peirce, and received the following reply:

LETTER OF PROFESSOR PEIRCE, SUPERINTENDENT OF THE U. S. COAST SURVEY.

"U. S. COAST SURVEY OFFICE,
"WASHINGTON, *15th February*, 1870.

"HON. CHAS. P. DALY,
"*President Am. Geog'l Society.*

"DEAR SIR,—I have the pleasure of furnishing you herewith a Table of the observed velocities of the Gulf Stream at three stations in the Straits of Florida, the vessel having been anchored in order to make the observations.

"Yours very truly,
"BENJAMIN PEIRCE,
"*Sup't U. S. Coast Survey.*"

TABLE.

Currents of the Gulf Stream observed in Florida Strait.

Station No. 1.—Lat. 24° 16′, Long. 82° 22′	current 2.3 miles per hour.
Station No. 2.—Lat. 24° 37′, Long. 80° 28′	current 2.0 miles per hour.
Station No. 3.—Lat. 25° 05′, Long. 79° 57′	current 1.7 miles per hour.

this direction, sailing from North Cape two hundred miles north-east and by north, when, discovering no symptoms of land, he took a direction south-east, and again turned to the north, and continued shifting and turning, in doubt and uncertainty, until he saw what is supposed to have been that part of Nova Zembla, known as Goose Cape; an expedition that had a dramatic close, as the event is touchingly told in the simple narrative of Hakluyt: "The vessels were separated at night in a tempest; one found her way into the White Sea by a route then unknown to Western Europe, and ultimately reached England; the other two, commanded by Sir Hugh, were discovered the following year by some Russian fishermen in the mouth of the river Varsina, in Nokinjiff Bay, on the coast of Lapland, with every soul on board of them, sixty-five persons, frozen to death; the journal in which the last incidents were recorded being found in the cabin. The two vessels were carried into Cholmaghoru, at the mouth of the Dwina, where the English residents of Moscow caused the dead bodies to be coffined and put on board the larger vessel, which, manned with a Russian master and crew, sailed for England, and was never afterwards heard of."

Barentz, the Dutch discoverer of Spitzbergen, in 1594 could get no further than the northern extremity of Nova Zembla. In his second voyage, in 1595, he sailed north, until he reached 80° N. L., discovering Spitzbergen; but finding his further progress in this direction impeded by ice, he retraced his route and endeavored to find his way along the eastern coast of Spitzbergen, and then struck out to the eastward until he reached Nova Zembla, when he turned again northwardly, but had to put back before large masses of drifting ice, which carried him around the northern extremity of Nova Zembla, until he was finally encompassed and frozen in for the winter in a bay at the N. E. of this desolate land, where his crew endured an amount of human suffering almost without a parallel, even in the history of Arctic discovery.

If the warm current of the Gulf Stream were running to the N. E., as Capt. Bent and Mr. Maury suppose, Barentz must

have crossed it and failed to notice it, anxious as he was to get to the northward; for his instructions were to avoid the coast of Nova Zembla and to push directly through the Northern Ocean, or, in other words, to go N. E. in the very direction where the Gulf Stream is supposed by Capt. Bent to run. In 1607 Hendrik Hudson attempted in this sea to put to the north and east until he was entangled in ice, and compelled to put back to Nova Zembla, where, even though it was the month of June, this most daring of navigators abandoned as fruitless any further attempt to get to the north or north-east in this direction.

It would involve too much detail to recount, over the period of two centuries and a half, the various attempts that have been made unsuccessfully to cross the Polar basin by sailing to the N. or N. E. in this quarter of the Arctic.*

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*Burroughs in 1570 reached the Waigatz, and Nova Zembla, but abandoned the hope of getting any farther. In 1580, Pet and Jackman approached Nova Zembla, but were enclosed in ice and had to return. In 1610, Poole pushed to 77° 25′ west of Spitzbergen in the attempt to reach the Pole, but had to put back; and upon his third voyage he narrates that Thomas Marmaduke had penetrated to the latitude of 82° north of Spitzbergen. In 1614, Fotherby went out in pursuit of a north passage. He reached to the latitude of 80°, when he found a great barrier of ice, in which he was embayed, and extricated himself with difficulty. Fotherby again went out in 1615 and reached the northern point of Spitzbergen, where he tried to find a passage to the Pole, but had to give it up and returned to England. From this time until 1773 all further endeavors to reach the Pole were abandoned; but that year Captain Phipps, afterwards Lord Mulgrave, was sent out by the English Admiralty to make the attempt. He came within view of the remote northern part of Spitzbergen, which the Dutch call North-East Land, 80 N. lat., 20 long. E., and attempted, but in vain, to get farther to the eastward. From the 80th parallel he saw but one unbroken surface of ice. In 1817, Scoresby was stopped in the same vicinity as Phipps had been, in the attempt to get eastward. In 1818 Buchan had a like experience in the attempt to push northward to the Pole north of Spitzbergen, reaching only to 80° 32′ N. lat., and came near losing his ship, which was for some time immovably fixed in the ice. In 1823 Clavering, having reached Cloven Cliff in the north part of Spitzbergen, endeavored to go northward, but could get no farther than 80° 20′ N. lat. In 1827 Parry worked his way northward and eastward with his ship to Walden Island north of Spitzbergen, when he had to put back to Hecla Cove, from which he made his unsuccessful attempt to reach the Pole by a land journey. All these attempts were made to the west or north of Spitzbergen. To the east-

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I will simply call attention to the fact that throughout the seventeenth century and for a considerable portion of the eighteenth, the Dutch were actively engaged in prosecuting a lucrative whale and seal fishery in the seas east and north of Spitzbergen. They constantly visited the island at its northern extremity, and the German Expedition of last year, in the Albert, found the ruins of their boiling establishment and numerous gravestones with their pious Dutch inscriptions still remaining. This industry, according to De Witt, in 1676 maintained 12,000 persons. In some years as many as 130 Dutch vessels were engaged in it. They have preserved in Holland a record of the voyages made by these Dutch fishermen from 1661 to 1756, and they amount to the large number of 17,461. In pursuit of whales and seals, the latter being very abundant, they penetrated to the north and eastward beyond Nova Zembla and westward towards Greenland, wherever open water was to be found, with all the hardihood and daring for which Dutch sailors at that period were distinguished, availing themselves of the earliest openings of the season and continuing to its very latest period. In short, they ransacked every portion of these seas, until, in the words of a Dutch historian, they fished them out; to which must be added the voyages of English, Scotch, Spanish, and American fishermen, who were actively engaged in these seas at the same period and afterwards. It is not unreasonable to suppose, that if this warm oceanic river were running through these seas with a volume and intensity sufficient to carry it, as Captain Bent imagines, to the Pole, these hardy, experienced, and adventurous mariners would have failed to find it out, and by means of it their way into the open sea, which, according to this theory, it serves to keep up in the vicinity of the Pole. The merchants of Amsterdam especially, and the States General, were then keenly alive to

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ward, between it and the northern extremity of Nova Zembla, the Arctic Ocean is very deep, and as the ice here moves in large masses to the southward, it may be that a vessel in this direction might get farther to the north than in any other part of the Arctic, but the undertaking is one of great difficulty and danger.

the importance of finding a passage across the Pole, or in that direction, eastwardly to the East Indies, as it would materially lessen the distance to India and give Holland, from her closer proximity to the north, a commanding advantage over the other maritime nations of Europe. Both the Amsterdam merchants and the Dutch Government had sent out several expeditions, and when they failed to accomplish this desirable object the States General offered a reward of ten thousand dollars to any private persons who might make the discovery of a north-east passage. Even if this incentive had not existed, would not these fishermen, intent upon the pursuit of whales and seals, when their number began to diminish, have naturally gone to search for them in this open Polar sea, as it was believed in then as well as now, if they could have found their way into it?

But Capt. Bent believes that they did, and Mr. Maury, in his article, refers confidently to what he calls "the positive facts" adduced by Capt. Bent from the archives of the Royal Society of London, that, in 1655, a Dutch whaler sailed in a perfectly free and open sea to within one degree of the Pole, and that about the same period another went two degrees beyond it, by following, says Capt. Bent, accidentally, the very pathway now pointed out by science as affording the only gateway to the Pole.

If these were well-ascertained facts, they would be conclusive as to the existence of an open and practicable passage by water to the Pole, and investigation would be limited to finding the route by which these fishermen reached it. So far, however, from being "positive facts," they are all founded upon hearsay of the loosest kind, which, although two centuries have elapsed, has never been confirmed. Capt. Bent frankly states what Mr. Maury seems to have overlooked, that the accounts of these voyages have been treated as fables, but that he, notwithstanding, believes them. It is apparent to my mind that Capt. Bent has never examined the evidence upon which these statements rest, and that he has accepted them because they tend to support his theory, and not from an investigation of the sources from which they

are derived. As so much reliance is placed upon them, I will show upon what they are founded; including, first, in the inquiry, that upon which Capt. Bent relies, and that we may have a general view of the whole subject, a great many more of which probably he has never heard.

In the latter part of the seventeenth century, there was in London, one Edward Moxon. He was the hydrographer of Charles II., a Fellow of the Royal Society, and the author of several tracts upon geographical and scientific subjects, one of which had some little reputation in its day. About 1655 Moxon was in Amsterdam, and about twenty years afterwards he communicated to the Royal Society what he had heard in Amsterdam of a Dutch fishing vessel that had sailed to the Pole and two degrees beyond it. That the Royal Society attached little or no value to his communication, I infer from the fact that I find no account of it in the Journal of their Transactions, which was then, as it is still, published annually. Disappointed, probably, at their want of appreciation, Moxon, in 1675, published what he had communicated, in the shape of a small tract, now very rare, but the essential particulars of which are preserved in the second volume of Harris's Collection of Voyages. The account is substantially this: That he went into a tavern in Amsterdam, in or about the year 1655, where he found several seamen sitting around the fire. That whilst he was there, another seaman came in who expressed great surprise at seeing one of the seamen by the fire, as it was not yet time for the arrival of the Greenland fleet, and that the other explained his early arrival by stating that he was steersman of a ship that had sailed to the North Pole and back, by the order of the Greenland Company. That he entered into conversation with this seaman, who told him that they had sailed two degrees beyond the Pole; that they saw neither land nor islands about it; but that there was a free and open sea, with fine warm weather, such as they had in Amsterdam in summer, and as hot; that the vessel was then in Amsterdam, and that many of the sailors belonging to her would confirm what he said; "which," Moxon says, "I believed, as he

appeared to be a plain, honest, unaffected person;" to which statement Moxon adds another account, which he heard from a Mr. Ben, in London, who told him that he went in a Dutch vessel to Japan, in 1668, and that they sailed from Japan due north, 27 degrees, in a free and open sea, without seeing any land or islands, which we now know to have been an impossibility. If Moxon had felt any interest in a piece of information so important, it would naturally be supposed that he would have sought out the vessel and conversed with the officers, or made further inquiries. It does not appear that he did anything of the kind, but that, after allowing twenty years to go by, he published this loose statement. It may be dismissed, with the observation that, if a vessel had then arrived in Amsterdam bringing intelligence so important, it would have created as much sensation there as would be created at the present day in this city should a vessel arrive bringing like intelligence. There was no subject upon which the mercantile mind of Holland was more intent; and if an Amsterdam vessel had actually reached the Pole, the fact would have been extensively known, and we should have it now upon the authority of Dutch geographers and historians, instead of resting, as it does, upon what this Fellow of the Royal Society heard in a tavern in Amsterdam.

When this tract of Moxon's appeared, there was in London an able and experienced seaman, Captain Wood, who believed the statements it contained, the more especially as one Captain Goulding, who had made thirty voyages to Greenland, had told the King that, twenty years before, he had been in company with two Hollanders to the eastward of Edge Island, and that, the whales not appearing, they had gone farther north, and returned in a fortnight, giving out that they had sailed to N. lat. 89°, *one degree from the Pole*, and met no ice, but a free and open sea, "a very hollow *ground* sea like the Bay of Biscay;" that he (Goulding) was not satisfied with this relation, whereupon they produced to him four journals of the two ships, and that they all agreed within four minutes. Wood was deeply impressed by all these accounts, and had personal influence enough to induce a body

of gentlemen to fit out for him an expedition to reach Japan by the way of the Pole, in command of which he sailed in 1776. Following the route recommended by Barentz, and in which Barentz believed to the day of his death, Wood, when he reached the North Cape, steered N. E., determined to reach the Pole by the very route which Captain Bent thinks is that of the Gulf Stream. He was unable, however, to get further than 76° N. lat. He was constantly running in openings in the ice, and was as constantly compelled to put back; until at last, after vainly attempting to get to the northward and eastward of Nova Zembla, he was shipwrecked upon that inhospitable land, and returned cured of all belief in a north-east passage or of a passage to the Pole. In his public statement he inveighed against those who, upon alleged information, lead unfortunate mariners to peril their lives in such hopeless attempts, and he makes an observation to which the attention of Captain Bent might well be called, that, "if there were a passage, there would be some current;" which, he says, "I could never, or very hardly, find, and the little that there was ran E. S. E."

The next statement is to be found in Harris's Collection of Voyages, the editor of which says, that a person, whose name he does not give, told him that there was no difficulty in sailing north about Greenland; that several Dutch vessels had done it; that the merchants, being required to verify it, desired that the journals of the Greenland Squadron of 1655 might be produced; that in several of them notice was taken of a ship which had sailed as high as 89° N. lat., within one degree of the Pole; that three of the journals of that ship being produced, they all agreed as to an observation taken by the master, Aug. 1, 1655, in 88° 56′ N. lat., and that it was also set forth in their journals that the sea was a hollow rolling sea like that in the Bay of Biscay. We here have the most minute particularity; not only the observation said to have been taken, but the day set forth upon which it was made; and although it is now more than a century since the editor of Harris published what this unknown person told him, nothing has ever been found to corroborate it.

The other statement referred to by Capt. Bent is to be found in the Philosophical Transactions of the Royal Society for the month of October, 1675. It is a paper by an anonymous writer, detailing what he declared had been discovered in the matter of a north-east passage. He says that a knot of merchants of Amsterdam had attempted these seas with better success than before, having advanced to the 79° and 80° N.L. That they passed over one hundred leagues above Nova Zembla to the east, which voyage the editor of Harris's Collection fixes, upon information which he says he had received, as occurring in 1679. This statement may be true, for Dutch voyagers and others have sailed north and east of Nova Zembla and found open water. The German Expedition in the present year, in the Albert, attained in this direction to 80° 14′ N. lat. and 90° 52′ W. long. The distance reached in this Dutch voyage of 1679 is loosely stated at about *one hundred leagues* of Nova Zembla. Capt. Bent, inadvertently no doubt, converts this one hundred into "several hundred leagues;" a very material difference, which I notice, because he gives great weight to his opinions by speaking of a "*careful* perusal of *all* the narratives of those who have made explorations in these northern seas, and that the history of these explorations was a part of his professional reading for upwards of a quarter of a century; which narratives he cannot have perused very carefully, or he would not have fallen into the error of coupling Barentz's Expedition with that of Willoughby's in the statement that they clung to the coast, which "led them down into the bight between Lapland and Nova Zembla, where their ships were respectively frozen in," nor have set down as a fact that Hudson reached to 81° 30′ north latitude, when from Hudson's own accounts of his bearings, and the fact that the northern extremity of Spitzbergen does not lie beyond 81° N. lat., geographers have long been agreed that Hudson must have been mistaken in his latitude, or that he mistook for land extensive fields or masses of ice.

But there is, as I have said, much more testimony of this loose kind not noticed by Capt. Bent. In 1663 Mr. Olden-

burgh, Secretary of the Royal Society, registered certain inquiries answered by a Mr. Grey, who, in one of his replies, said that he had once met in Greenland a Hollander who *swore* that he had been but half a degree from the Pole, showing him his journal, which was attested by the mate, and that they had seen neither ice nor land; and *Birch*, in his history of the Royal Society, says that he read these inquiries to three very intelligent masters of Greenland ships, and that they confirmed them in every particular. Daines Barrington, in a paper read before the Royal Society in 1774, says that a Mr. Watts told him, a quarter of a century after the event, that when he was 17 years of age, in 1751, he was in a vessel employed in the Greenland fisheries, the captain of which determined to reach the Pole, and that he sailed without the least obstacle to 83½° N. lat., where the sea was still open to the northward; that they did not see a speck of ice after passing the 80° parallel; that the weather was temperate; that he had never experienced a more pleasant navigation, but that when they got to the point stated, the captain desisted from his attempt to reach the Pole, because the mate complained that the compass was not steady, and the captain feared that if any accident should happen he would be blamed for going further, after the mate's protest.

A Dr. Daillie, 50 years after the event, told Campbell, the editor of Harris's Voyages, who narrated it 30 years afterwards, that he, Daillie, when a young man, was on board a Dutch vessel of war, sent out to superintend the Greenland fisheries; that the captain determined to try if he could not reach the North Pole, and penetrated, according to Campbell's recollection, to 88° N. L., where the weather was warm, the sea free from ice and rolling like the Bay of Biscay, but that, as in the former case, the captain would not go any further, for fear that he would be blamed in Holland, and that he would suffer no journal to be made.

In Miller's "Gardener's Dictionary," it is said that a Capt. Johnson, in a voyage to Greenland, regulated his thermometer by the degree of cold which he found at 88° N. L. Buffon, in his Natural History, says that he was assured by a per-

son of credit, that an English captain, named Monson, directed his course to the Pole and came within two degrees of it in an open sea without any ice; and Buffon afterwards gave as his authority a Dr. Hickman, a Fellow of the Royal Society in 1730. A Capt. Wheatley told Barrington that when off the coast of Greenland in 1766 three Dutch captains told him that a vessel of their nation had reached to the 89th parallel, one degree from the Pole. A Mr. Reed also told Barrington that when in the Greenland seas, a Dutch captain, Hans Derrick, informed him that he had been as far as 86° N. lat.; that there were only small pieces of floating ice in the water, and that at the same time there were five other ships in his company, all engaged in this high latitude in catching whales.

Campbell, in his continuation of Harris's Voyages, says: "By the Dutch journals they got into N. lat. 88° 56′ with the sea open. When asked where he got that information, he stated that he had received it from Holland 30 years previously, and that it was an extract from the journals produced to the States General in 1665. If he had an extract from these journals, it is to be suposed that he would have published it; so that his statement simply amounts to what he had heard from Holland 30 years before."

Dr. Hamel, the author of the interesting work on England and Russia, says that the highest point gained was by James Bisbrown, who sailed from Liverpool in 1765 and reached to north latitude 83° 40′, where he found the sea still open. The Doctor does not state, and probably did not know, upon what it was founded. It was told by a seaman, whose name is not given, to Capt. Hiatt, a military officer, who communicated it to Barrington in 1776.

One John Adams, a schoolmaster in Essex, England, told Barrington that he was in the Unicorn, Capt. Grey, in 1754, who was then upon his fifty-ninth voyage to the Arctic; that a good observation was taken; that they found the vessel to be in north latitude 83°; that the captain and Adams went to the mast-head, from whence they saw a sea as free from ice as any part of the Atlantic, and that it was the united

opinion of Adams and the officers of the ship, that they might have reached the North Pole. Why they did not attempt it, is not stated. One Montgomery, a merchant of London, who had been the master of a whaler, also told Barrington that he had followed the whales in the month of June, in 1756, until he reached 83° north latitude by observation.

A Mr. Stevens told Maskelyne the astronomer, in 1773, that he was driven in a Dutch ship, in the month of May, off Spitzbergen into N. lat. 84° 30′, and returned in June; that they saw no land after sailing north of Spitzbergen; that they did not find the cold excessive; that they only used common clothing; met no drift wood, but little ice, and less the further they went to the north.

Those who, like myself, have passed years in the daily occupation of sifting and weighing testimony, know that little or no value whatever is to be attached to evidence of this description. The memory of witnesses after a lapse of time cannot be depended upon in matters of detail, even in affairs in which they have been actors. The literature of maritime discovery abounds with misinformation of this kind, detailed with as much particularity and apparent credibility as this is. Seamen, to whom much of it is to be traced, are proverbially unsafe in respect to what they have seen and known, where exactness or positive facts are essential. Inaccuracy in latitudes, moreover, was the general experience during the principal period covered by these reports, for Hadley's quadrant was not invented until 1731 and the astrolabe previously in use, though reliable enough upon the land, was so affected by the motions of a ship that its accuracy at sea could not be depended upon. But there is something more conclusive than this.

In 1773, an investigation was instituted by Professor Allman, of Leyden, to ascertain how near the Dutch whalers had reached to the Pole. Inquiries were instituted at the Helder, where the greatest number of them live and where their expeditions were fitted out. It was conducted by Capt. May, an officer in the Dutch service, assisted by the eminent Dutch cartographer Van Keulen. Capt. May particularly

applied to those commanders who had made the greatest number of voyages, and "found them," as he says, "men of candor and penetration." Journals were inspected, old maps and charts examined, and every thing sought for in the way of information. The result was, that scarcely a year had passed without some of them getting as far as 81° north latitude, but they rarely found the sea free from ice. That two English ships sailed to the north and returned in ten days, and claimed to have gone as far as 83° N. lat. without any obstruction from ice, and could have gone further, but, finding no whales, had returned. That the most northern voyage ever heard of at the Helder, and one upon which they could with certainty depend, had been made by one John Schol, in 1700, who, according to his reckoning, had reached as far as 84° N. lat.; to which may be added, in conclusion, that they were all asked what course they would take to reach high northern latitudes, and the answer was that they would never seek it to the west of Spitzbergen, but run out to the north from the westward of Nova Zembla; this information, so far, favoring the route advocated by Capt. Bent.

I now come to that part of the theory of Captain Bent which assumes that there is a current running through Behring Straits to the Pole, which I may appropriately preface with the observation of an experienced seaman and Arctic writer, Staff Commander Davis, R. N., that of all the proposed routes to the Pole this is the most speculative and the most hazardous. Captain Bent has not furnished one particle of evidence of the existence of the warm current which he supposes, and Mr. Maury represents, as running north-eastwardly from Behring Straits to the Pole. Progress northward or north-eastward, in this direction, has been found more difficult, dangerous, and more impeded by ice, than in the region east or west of Spitzbergen; in confirmation of which I may refer my hearers to the voyage of Captain McClure, the discoverer of the Northwest Passage, in the *Investigator*, between the years 1850 and 1854.

There is a strong current running through Behring Straits. Kotzebue, in 1815, observed by the course of the drift wood

that it ran along the coast to the N. E.; that it was more powerful on the Asiatic side, and that its velocity in different parts was from one to three miles an hour. He found the land on the American side, in the Sound which bears his name, *green* as far as the eye could reach; flowers were in bloom, and no snow could be seen except on the tops of distant mountains, and yet, upon digging but half a foot deep, he found nothing but ice beneath this verdant carpet. He estimated the current on the Asiatic side, when the wind blew from the south, to be three miles an hour. Its course was always N. E. in Behring Straits, and stronger and much colder on the Asiatic than on the American coast; and he concluded that, as the current in Baffin's Bay runs to the south, the mass of water which flows into these straits takes its course around America and returns through Baffin's Bay to the Atlantic Ocean.

Capt. Bent states that Kotzebue attempted, in 1815, to pass to the west around the Asiatic coast and was barred by ice, and that Kotzebue says "the sea was open to the north-east as far as they could see." There is no such passage as the one quoted by Captain Bent, in Kotzebue's narrative, nor did he attempt to pass to the west around the Asiatic coast. He merely crossed from Cape Krusenstern, on the North American side, to East Cape, on the Asiatic side; whence he returned south, through Behring Straits, and says nothing about being barred by ice, but only of the current, which carried him in the fog, 50 miles in 24 hours, back upon his course. Kotzebue, in his second attempt in July, 1817, got no farther than the eastern part of St. Lawrence Island, in consequence of the sudden formation of ice, "and my hope," he says, "of penetrating Behring Straits was blasted."

Kotzebue, when exploring the southern part of the great bay or sound, which bear his name, says that he sent a sailor to the mast-head, and he announced that there was still nothing but open sea to the north-east. Captain Bent, I infer, has confounded this observation made in the interior of Kotzebue's Sound, and at the farthest extremity of it to the southward and westward, with the navigator's exploration off Icy Cape

on the Asiatic side, as it is not to be supposed that the Captain would intentionally, in support of his theory, insert, as from Kotzebue's work, a passage not contained in it. There is open water along this part of the North American continent, through which Captain M'Clure found his way to the westward and then to the northward, until the *Investigator* was frozen in and abandoned in Mercy Bay; but whether this is due to the influence of a warm current, flowing from Behring Straits in this direction, or, as Capt. Long supposes, to the action of the rivers which flow into this part of the Arctic, or to the influence of warm south-westerly winds, is in the present imperfect state of our knowledge simply a matter of speculation. That there is a current through the Arctic, from the Pacific to the Atlantic, may be presumed from the fact that the *Resolute*, abandoned by Capt. Kellett in the ice near Cape Cockburn, in Barrow Straits, in May, 1854, was found by an American whaler, in September, 1855, in Davis Straits, near Cape Mercy, having drifted over one thousand miles; and the running of a strong current has been seen, through openings in the ice, by Sir Edward Belcher and others; all of which tends to confirm the supposition of Kotzebue that the current running N. E. through Behring Straits passes out through Davis Straits; but Capt. Bent's supposition of a current running N. E. from Behring Straits, through which an open passage in this direction may be found to the Pole, is a speculation which, so far, has not a single fact that I have been able to discover to support it, and with this observation I quit this branch of the subject, leaving it to my hearers to determine what ground there was for assuring the public that a way to reach the Pole had *at last* been found.

Capt. Kellett, in the *Herald* in 1849, saw land extending with high peaks, N.W. of Behring Straits, which he thought a continuation of the land seen by the natives off Cape Jakan, in Asia, mentioned by Wrangel.

Capt. Bleven, in 1867, in lat. 71° 20′ N., long. 175° W., eight miles south of Wrangel's Island to N.W. of Herald Island, saw ranges extending as far as the eye could see.

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Capt. Raynor, in 1867, in the *Reindeer*, saw, W.S.W. of Herald Island, land extending, with peaks; he sailed along the south and east sides of it three times, and for a considerable distance. He found its extreme S.W. cape to be 70° 50′ N. lat., 178° 15′ E. long., and its S.E. cape 71° 10′ N. lat., 176° 40′ W. long. The southern coast he found high, with projecting cliffs, and very barren. The coast ran from the S.E. cape N.W. for 15 miles, and then turned to the N.E. There was an island lying E. of it in 170° W. long., and N.W. of Point Barrow, *with* a *passage between* it and the *land described*. He found the current here running to the west from one to three knots an hour, and he says, that at long. 170 W. the ice barrier is always 50 to 80 miles farther south than is found to be the case between that longitude and Herald Island, and that there is always a strong current setting to the N.W. between these two points. That currents are changed by the winds in the shoal waters of the Arctic, which he thinks indicates that there is a passage in that direction where the water passes between two barriers of land, that hold the ice; one of which is known, and the other is unknown. The S.W. cape of the island he saw was 25 miles from the Siberian coast.

Capt. Long, in the same year, in August, 1867, which was a favorable one for discovery, saw land whilst in lat. 70° 46′ N., long. 178° 30′ E., and was about 18 miles from the west point of it. The lower part was free from snow, and had a green appearance as if covered with vegetation. He sailed along the east of it, and, near the centre, in long. 180° W., he saw a mountain, that appeared to be volcanic, the approximate height of which was 2,480 feet. The east cape of the land, which he named Cape Howaii, he found to be in N. lat. 70° 40′, long. 178° 51′ W. He could not say how far it extended, but he saw mountains until they were lost in the distance. He gives it as his opinion that the true way to reach the Pole is to sail from some point between Capes Kekurnai and Schelagskoi, in a course from N. to N.W. until north of Liakov islands, and thence to the North Pole and Spitzbergen. "I have more faith," he adds in conclusion, " that the passage from the Atlantic to the Pacific will be ac-

complished by one of these routes, than I had in the Atlantic telegraph fifteen years ago." We shall probably get some further information respecting this part of the Arctic, east of Behring Straits, from the Russian Expedition under Baron Maydell, to which I before referred, although the expedition was not, I believe, designed to explore the seas to the eastward and northward, but for exploration chiefly upon the land; with instructions, however, to ascertain if land northward was visible from the Siberian coast, as the natives informed Wrangell, and near which it was seen by Capt. Long.

The English Arctic navigators are divided in opinion as to whether it is best to attempt to reach the Pole by going directly north of Spitzbergen, or to make the next attempt by the way of Smith Sound.* Our explorers, Dr. Hayes and Capt. Hall, are in favor of Smith Sound, in which they have the support of that experienced English Arctic navigator, Capt. Sherrard Osborne, who has recently read a very able paper before the Royal Geographical Society, earnestly recommending it; and there is the route, advocated by Capt. Long, east of Behring Straits, by the way of the Liakov islands, to Spitzbergen, which may be attempted by the French Expedition of M. Gustav Lambert, as it is designed for explorations in this quarter of the Arctic. That the Pole will be ultimately reached I entertain no doubt, though, so far as an opinion can be formed from what is known, I doubt if an open passage to it for a vessel, exclusively by water, will be found. The better method, I am inclined to believe, is to go prepared also for sledge boat explorations upon the land when the farthest point by water has been reached, especially if the attempt is made by the way of Smith Sound, or north of Spitzbergen.

It had been my intention to give the reasons why, in a geo-

* Admirals Back, Collinson, Wrangell, Sir Lionel McClintock, Staff Commander Davis, and Captains Osborne and Hamilton are in favor of Smith Sound, whilst Admirals Belcher, Ommany, and Fitzroy, General Sabine, President of the Royal Society, and Captains Richards, Inglefield, and Young are for the route north of Spitzbergen.

graphical and scientific point of view, the discovery of the Pole was of great importance; but my limits forbid.* There is now throughout Europe the greatest activity prevailing, and the deepest interest felt, in the attainment of this object, which will never cease until the end is accomplished. Our country has as deep an interest in it as any other, and yet our own Government has done comparatively nothing. It is to be hoped that Congress will be awakened to a sense of what is due on the part of a nation so energetic and enterprising as ours. To do anything effectually, it must be done by our Government; and in this emulous strife of nations it would be a proud distinction for us, and a noble vindication of a marked feature in our national character, should the flag which bears as its emblem the stars that guide the mariner, be the first to wave over this pivot of the globe.

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* They will be found elaborately set forth by M. Gustave Lambert in the *Bulletin de la Société de Geographie, Paris, December*, 1867.

APPENDIX.

ALPHABETICAL LIST

OF

DONORS

TO THE

LIBRARY AND MAP ROOMS.

INSTITUTIONS.

American Antiquarian Society in Cambridge, Mass.
American Antiquarian Society in Worcester, Mass.
Academy of Natural Sciences, Phila., Pa.

Boston Public Library.

Connecticut Academy of Arts and Sciences.
Cornwall Polytechnic Society, England.
Chamber of Commerce, New York.

Department of Education, Washington, D. C.
Department of the Navy, Washington, D. C.

Essex Institute, Salem, Mass.

Ferdinandeum in Insbuck.
Frankfurter Verein für Geographie u Statistik.

Geographical Society of Geneva, Switzerland.
Geographical Society in Paris.
Grossherz. Verein in Darmstadt.
Grand Ducal Statistical Bureau in Carlsruhe, Berlin.

Hungarian Academy of Sciences, Pesth, Hungary.
Hanseatic Legation in New York.

Imperial Academy of Sciences, St. Petersburg.

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Imperial Academy of Sciences in Vienna.
Imperial Agricultural Society, Lyons, France.
Imperial Public Library, St. Petersburg.
Imperial Royal Geographical Society in Vienna.

Königl. Preussisches Statistisches Bureau in Baden.
K. K. Geologische Reichs-Anstalt in Vienna.

Manchester Statistical Society.
Manchester Public Free Library.
Manchester Philosophical Society in Manchester.

North China Branch of the Royal Asiatic Society.
New York Bible Society.
Natural History Society of Altenburg.
Naturforsh. Gesellschaft in Emden.

Observatory of Pulkova, Russia.

Peabody Institute, Baltimore, Md.

Royal Academy of Sciences in Munich.
Royal Society of Victoria, Melbourne, Australia.
Royal Society of Belgium in Brussels.
Royal Bureau of Statistics in Stockholm.
Royal Academy of Sciences in Copenhagen.
Royal Society of Sciences in Copenhagen.
Royal Society of Sciences in Göttingen.
Royal Meteorological Institute of the Netherlands.
Royal Geographical Society of London.
Royal University in Christiana.
Royal Physical and Oeconomical Society in Konigsberg, Prussia.
Royal Society of Sciences at Prague, Bohemia.

Smithsonian Institution, Washington, D. C.
Societé Royale des Sciences d' Upsala.
Statistical Society, London.
Statistischer Verein der Stadt Frankfurt.
State Historical Society of Wisconsin.

University of Lund, Sweden.

Verein für Erdkunde in Leipzig.

INDIVIDUALS.

Batchelor, Geo., - - - - New York.
Barnes, W., Sup't Insurance Dep't, - Albany, N. Y.
Bent, Capt. Silas, - - - - St. Louis, Mo.
Berghaus, H., - - - - Gotha, Germany.
Blunt, Geo. W., - - - - New York.
Blunt, Orison, - - - - - New York.
Bouton, J. W., - - - - New York.
Brace, Charles L., - - - - New York.
Bradley, Rev. D. B., - - - - Bangkok, Siam.
Bavarian Consul, - - - - - New York.

Chambers, Jno. W., - - - - New York.
Chanler, Hon. Jno. W., m.c., - - Washington, D. C.
Chief Clerk Navy Department, - Washington, D. C.
Churchill, Jno. & Son, - - - London, England.
Coffin, J. H. C., Sup't Bureau Navigation, Washington, D. C.
Conger, Hon. A. B., - - - - New York.
Conkling, Hon. F. A., - - - - New York.
Conkling, Hon. Roscoe, u.s.s., - Washington, D. C.
Cowdin, Hon. Eliott C., - - - - New York.

Daly, Hon. Chas. P., ll.d., - - - New York.
De Costa, Rev. B. F., - - - - New York.
Disturnell, Jno., - - - - - New York.
Drowne, Henry T., - - - - New York.

Engel, ——, m.d., Chief of the Roy. Stat. Bureau, Berlin, Prussia.

Field, Cyrus W., - - - - New York.
Fish, Hon. Hamilton, Secretary of State, - Washington, D. C.
Fock, William C., Minister of the Interior, Pesth, Hungary.

Garcia y Garcia, D. Jose A., - - - New York.
Gibbs, Geo., - - - - - New York.
Green, Andrew H., - - - - New York.

Hagedorn, Consul, - - - Philadelphia, Pa.
Harbough, S. G., State Librarian, - Columbus, Ohio.
Harris, Hon. Townsend, - - - - New York.

Harrison, Thos. F., - - - - New York.
Hartley, R. M., - - - - New York.
Hincks, Rev. Wm., - - - Toronto, Canada.
Hitchcock, Prof. C. H. - - -
Hochstetter, Ferdinand von, m.d., - - Vienna.
Huff, Sanford N., m.d., Rec. Sec. State Hist. Soc. - Iowa.

Jenkins, T. A., Chief Clerk Bureau of Navigation, - - - - Washington, D. C.

Lovell & Gibson, - - - - Toronto, Canada..
Lucca, F. de, Consul General of Italy in - New York.

McCartee, Rev. D. B., Missionary in Ningpo, - China.
McDermott, Lewis, - - - - New York.
Malte-Brun, V. A., - - - Paris, France.
Metcalfe, Geo. T., Chief Clerk Department of the Interior, - - - Washington, D. C.
Monchez, Capt. E., Imperial Navy of France, - Paris.
Morgan, Hon. E. D., u.s.s., - - Washington, D. C.
Morse, Prof. Samuel F. B., - - - New York.

Naphegyi, Dr. G., - - - - New York.
Nye, Gideon, U. S. Consul in Canton, - - China.

Parish, Jr., Robert, - - - Philadelphia, Pa.

Peirce, Prof. B., - - - Washington, D. C.
Petermann, Prof. A., - - - Gotha, Germany.
Poey, Andres, - - - - - New York.
Publishers De Bow's Review. - - - New York.

Remsen, William, - - - - - New York.
Renwick, Heirs of Prof. James, - - New York.
Rösing, Johannes, Consul General of Prussia, - New York.

Scott, J. W., - - - - - Toledo, Canada.
Shannon, Joseph, Clerk Common Council, - - New York.
Sigourney, A. P., Secretary Jefferson County Agricultural Society.
Simmons, D. B., m.d. - " " Yedo, Japan.
Squier, Hon. E. Geo., - " " " New York.

Stewart, Hon. Thomas E., M. C.,	Washington, D. C.
Stout, Francis A.,	New York.
Surgeon-General U. S. Army,	Washington, D. C.
Sweet, H. D. L.,	Syracuse, N. Y.
Todd, A., House of Commons,	Canada.
U. S. Commissioner of Agriculture,	Washington, D. C.
Van der Weyde, Prof. P. H.,	New York.
Vela, J. M.,	New York.
Walling, H. F.,	New York.
Wilson, Jos. S., Commissioner Land Office,	Washington, D. C.
Wickes, Geo. T., Engineer Pacific Railroad.	

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Subscribers to the Special Fund in 1868, *for the purpose of refurnishing the new rooms in the Cooper Institute:*

Hon. Chas. P. Daly,	$100 00
Francis A. Stout,	100 00
William T. Blodgett,	100 00
Hon. F. A. Conkling,	100 00
William Remsen,	100 00
Isaac I. Greenwood,	100 00
Henry Clews,	100 00
T. Bailey Myers,	100 00
Cyrus W. Field,	100 00
Levi P. Morton,	100 00
Total,	$1,000 00

Subscribers to the Special Fund in 1868, *to purchase books of a more recent date, and to complete the Library of the Society:*

Hon. Chas. P. Daly,	$25 00
Francis A. Stout,	25 00
Hon. F. A. Conkling,	25 00

William T. Blodgett,	$25 00
William E. Curtis,	25 00
William Remsen,	25 00
Isaac Bernheimer,	25 00
Henry Clews,	25 00
Henry B. Hammond,	25 00
TOTAL,	$225 00

Subscribers to the Special Fund in 1869, *for the purchase of Henry Stevens' collection of rare geographical works and atlases:*

James Lenox,	$500 00
John D. Wolfe,	500 00
T. C. Durant,	500 00
Wm. C. Rhinelander,	500 00
Marshall O. Roberts,	250 00
Atlantic Mutual Insurance Co. of New York,	250 00
Robert L. and Alexander Stuart,	200 00
Howard Potter,	150 00
Theodore Roosevelt,	100 00
Frank Leslie,	100 00
George C. Ward,	100 00
Legrand Lockwood,	100 00
N. M. Beckwith,	100 00
Samuel J. Tilden,	100 00
Robert Mackie,	100 00
Isaac Bernheimer,	100 00
Henry Clews,	100 00
Edward Matthews,	100 00
Hon. Chas. P. Daly,	100 00
R. A. Witthaus,	100 00
James W. Gillies,	100 00
Hon. Townsend Harris,	50 00
Orient Mutual Insurance Co. of New York,	50 00
Mercantile Mutual Insurance Co. of New York,	50 00
Union Mutual Insurance Co. of New York,	50 00
Pacific Mutual Insurance Co. of New York,	50 00

Eugene Kelly,	$50 00
Geo. H. Purser,	50 00
Chas. H. Marshall,	50 00
Chas. L. Tiffany,	50 00
William F. Cary,	50 00
Frederick Schuchardt,	50 00
Thos. H. Faile,	50 00
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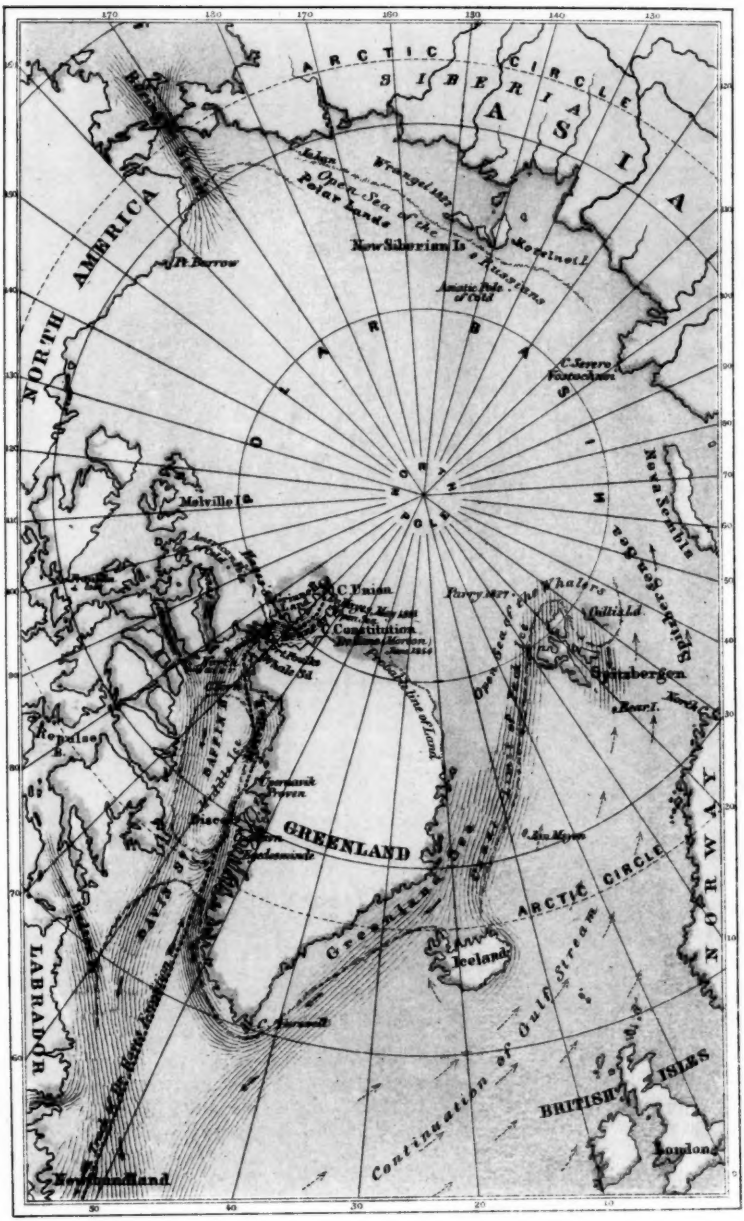
PART II.

PAPERS READ BEFORE THE SOCIETY.

(N.B.—The Authors are alone responsible for the contents of their respective papers.)


ARCTIC CIRCLE
ASIA
SIBERIA
NORTH AMERICA
Open Sea of the Polar Lands
New Siberian Is.
Wrangel Land
Asiatic Pole of Cold
C. Jesnoy
Melville Is.
Nova Zembla
Spitzbergen
Whalers
Greenland Sea
GREENLAND
Iceland
LABRADOR
Newfoundland
BRITISH ISLES
London
Continuation of Gulf Stream

JOURNAL OF THE AMERICAN GEOGRAPHICAL AND STATISTICAL SOCIETY.

I.—*Address on Arctic Exploration.* By Dr. I. I. HAYES.

Delivered November 12, 1868.

Mr. President: Gentlemen of the Geographical Society:

I BELIEVE I owe my invitation to address you and the ladies who kindly grace our meetings, to the circumstance that the German and Swedish expeditions of the past summer have awakened a slumbering interest in the progress of Arctic discovery.

Although I have for several years been more or less identified with this subject, it is, perhaps, not inappropriate for me to observe at the outset, that I do not propose to address you as one having a cause to advocate or a theory to prove; but rather as a member of a scientific society which has assumed to itself the charge of important interests, and to which the public naturally look for instruction upon those matters with which we are concerned. For our science is essentially a popular one. We have all of us constant occasion to refer to its earliest as well as to its latest records. It is derived from many sources. In some sense it might be said to cover almost the entire field of human knowledge. As Malte-Brun has well observed, it is a "living picture of the Universe," rather than, as it is too often considered, a mere enumeration of the various rivers, mountain chains, and countries, with their respective lengths and heights and populations—pedantic dryness, which has not failed to make geography the least pleasing where it should be the most attractive of studies.

Geography might indeed be likened to an unfolding scroll, ever fresh with novelties to please the mind and delight the fancy. We read there the general progress of all the sciences and of the arts; of the influence of religion upon communities

of men, and of schemes for their advancement; of everything, indeed, which concerns human history; of barbarous peoples brought within the pale of civilization, of new lands for enterprising men, new products for the lap of commerce.

The subject is indeed so comprehensive in its nature, that I feel tempted to approach my own immediate theme through its pleasant atmosphere. And this is not inappropriate. One-half the value, and all the living interest, is lost by the study of geography mathematically; that is to say, by the study of any part of the globe without reference to the links which connect the local history with the general progress of geographical knowledge. Like some great river discharging to the sea through a wide-spreading delta, the intricacies of which can only be fully comprehended by approaching from above; or like a human life, whose written history cannot have value unless the biographer has mastered the key—the secret motives to its successes and defeats, its sorrows and its joys; so if we would properly study a particular department of geography, we must learn the causes which led to the present state of our information.

Pardon so trite an argument, but it is sometimes necessary to assert a truism before we can illustrate a proposition.

Going back into antiquity we have two of the most ancient nations of the earth pictured to us in the writings of Moses and Homer. These were the first of geographers. Thus at least we should style them if we apply the term to descriptions of people and the places they inhabit. If the human laws of the one were divine, and the sublime poetry of both an inspiration, their simple statements are but an intellectual appreciation of what they saw, and what they knew. And what they have told us is indelibly fixed upon our minds. We know the customs of their respective peoples, and the character of their respective countries; we know the nature of the hills, mountains, plains, and rivers, the valleys and the fields of grain. With the one we wander by the tents of the captive tribes, with the other we overlook beleaguered Troy. We gaze wonderingly at the silvered summit of Olympus, we stand reverently at the foot of Sinai, and, by the fountains of the Euphrates, we linger in the cradle of the human race.

Thus geography began. Then Herodotus, "the father of history," the Strabos, the Plinys, the Ptolemys, follow with descriptions of the world as unfolded by the bold Phœnician sailors, who, guided only by the stars, threaded their way along the Mediterranean to the Atlantic Ocean; by the ad-

venturous voyage of Pytheas the Greek mariner and trader of Massilia, who first brought the west into view, and created conjectures respecting the north; by the vast colonial system of Carthage; by the light which flashed up from the East above the military glory of Alexander; and by the gathering at length of all these discoveries and conquests beneath the sceptre of the Roman Cæsars.

And this was the then world; how small a part of it the Romans only knew when savage hordes from vast regions of which they had not even dreamed, swallowed up their empire, and left the monuments of their civilization—their temples, their colosseums, the arches of their triumphs—but a waste of smouldering ruins.

Here ancient Geography ends, and darkness worse than Polar night weighed down the human mind for centuries, until Phœnix like it rose again from its own ashes.

Modern Europe came into being with this new birth of intelligence. There was now another world, vaster than that of Rome. Modern Geography took its rise. The spirit of travelling was revived. That spirit had already in the dark ages guided the Arabs to the Moluccas, and the Scandinavians to Iceland, Greenland, and even to America; but no science accompanied these adventurous people to gather the fruits of their bold undertakings.

The Italians, Spaniards, and Portuguese take the lead in the new day which is dawning—in this new period of intellectual energy which followed the dark ages as a health-giving air comes with fresh breezes from the sea, lifting the death-dealing miasma that breeds within the pestilential swamp.

These men traverse the high seas with confidence. Possessed now of an unerring pilot, they grow fearless. From the bowels of the earth has come a dark, grayish-brown metallic ore, which is to work a mighty revolution. First found near Lydia in the province of Magnesia (whence its name), as *ferrum vivum*, it was known to the ancients, and was a familiar toy to Aristotle and Pliny.

They knew not the treasure they possessed. They knew not that its tenderest touch transformed a piece of steel, and fixed it in the meridian of the earth. They knew not that within their hands, as "paper weights," perhaps, upon their parchment-strewn tables, lay a silent force that was in time to sweep away their Hesperian gardens, and whose influence would reach beyond the dark *Thule* of their imagining—beyond the barrier of the North that was neither air, earth, nor water; be-

yond the great Morass of the West, made by the sinking of the Island of Altantis; beyond the fiery regions of the South, where everything was melted or broke out in flame—to seas and lands indeed beneath their very feet, even to the fulfilment of the prophecy of the poet Seneca:—"Ages shall come in which Oceanus may unloose the bonds of things, and a vast land may be exposed, and Typhis may discover new worlds; and there may no longer be an *ultima thule* on earth." They little knew that this "quick-stone" would cause ships to come and go upon all the waters of the earth,—steering their course along the trackless highway with as much ease and certainty as they then navigated from one headland to another.

Yet this was soon to be. The magnetic needle giving confidence, the ship's prow is turned from the land. De Gama stands out boldly to the South from the Cape de Verde Islands, and finally passes the Southern Cape of Africa; Andreada, following upon his track, reaches China; and Columbus, inspired by conviction, and guided by the same silent and mysterious monitor, conducts to a new world.

Thus from opposite directions has Europe caught glimpses of the wondrous East, from the trade of which, by the old land channels, all Christian peoples had been shut out by the letter of Pope Nicholas IV., in the year 1291, forbidding traffic with the heathen. But now to their very doors has come upon the watery highway the land of spices and of pearls—the Ophir whence the Phœnician traders fetched the rich treasures to King Solomon; whence Lucullus drew the splendors that adorned his banquets; whose marvellous legends inspired the zeal of the Macedonian conqueror, and were now to inspire other bold men to deeds of equal daring—to send Cortez to Mexico, the Pizarros to Peru, De Soto to the Mississippi, Cartier to Canada, and a host of Portuguese adventurers by the southern sea to Hindostan.

And thus did all the civilized nations enter almost simultaneously upon a career of discovery—not only by the western ocean, across which the great pilot of Genoa had led the way, but by the South and East and North as well; until, pressing on and on, they meet at length from opposite directions, and thus prove the world is round.

"In olden times the mind of man was chained;"

but now the barriers raised by ignorance, prejudice, and superstition fall to pieces, and to wondering ears an Italian poet sings this strange song:

"Deep beneath our feet are other towns
And powerful realms, till now undreamt of;
And Hercules will look around and blush,
To see how far the bounds in vain he set;"

and surely he must have been much astonished when he looked about him and saw

"How far his Pillars high, in vain, were placed."

There was, indeed, no more an end to the adventurous spirit which now possessed the world than there was to the world itself, and the whole earth became an easy conquest when Magellan found at last the strait which he had sought, and first marked with vessel's keel a track around the globe.

Thus did the tide roll on, until "the whole vast theatre of the earth, with some partial shades, was opened to the gaze of science."

Into one of these partial shades you and I, gentlemen, have, each in our way, been peering, with the hope that we would see the curtain rise and let the light of science in upon that dark region around the North Pole, toward which we have all been drawn from childhood by the ever-powerful charm of the unknown.

To that mysterious region the late Dr. Kane left us the legacy of a route. Encouraged by your support, he was enabled to indicate a plan by which, as it seemed, could be solved some of the most interesting of the remaining problems of geography—problems which have occupied the minds of thinking men since the bold Pytheas first glided to the western ocean between the Pillars of Hercules—problems which have been overclouded with myths since the Hellenic poets first made the Hyperborea of their fancy inaccessible by land or sea, and peopled it with beings who were exempt from disease and old age, from toils and warfare and death.

One of these problems is that of the open Polar Sea.

The gallant efforts of Burton, Speke, and Baker have shown us the sources of the Nile, but the open Polar Sea remains among the few great geographical questions yet unanswered —unanswered I mean, however, only in the sense of its actual navigation.

Aiming to follow in the footsteps of my former commander, I had the honor, eleven years ago, to bring to your notice the scheme of a voyage for the accomplishment of that much desired end. It is eight years and a-half since the voyage was begun, and seven since it was ended.

This interval of seven years, so full of surprising changes in the civilized communities of the earth, so prolific in discoveries for the promotion of personal convenience and national power, has spread our geographical knowledge practically no nearer to the North Pole than formerly, although I would by no means disparage the recent gallant efforts of the Germans and Swedes, nor of the confirmation of the Polar Land brought by Captain Long from Behring Strait. Yet the same curtain whose web is wonder and whose woof is awe, still hangs over the region about the axis of the globe, and we are still as curious as ever to peer beneath it, and to write the final record on that great scroll which is the science that we love.

The history of Arctic discovery is an interesting study. It had its origin in the first period of modern intellectual growth. It is coeval with the discovery of America. It arose not from the love of science, but from a love of power; not from the love of discovery for its own sake, but in the hope that by the North the Indies might be reached—that land of so much promise—the Orient which the ancients knew, which Marco Polo and Sir John Mandeville had latterly described in language as quaint as it was exaggerated; to gain which kings sold their honor and queens pawned their jewels; the struggle for which filled the world with wars and bloodshed, and converted it into a pandemonium of jealousy and strife; to reach which was to reach a land ruled by princes throned in gold and silver, breathing an atmosphere perfumed with sweet spices, and where gems were plentiful as the dewdrops that sparkle in the morning sun.

Thus had the Kublai Khan of Polo's narrative become celebrated, thus had his riches been magnified, and thus did the half savage ruler of the Tartar tribes become the central pivot around which were to revolve the hopes of Christendom.

Then India and America were one. Columbus died in that belief—in the belief that he had touched the Khan's great territories.

I have before me a copy of the map of the French geographer Orontius Fines, of 1531, "cut out in the fourme of a harte," as quaintly described by Richard Willes. The possession of this rare treasure I owe to my very kind friend Mr. J. Carson Brevoort, whom we all know as one of our most accomplished geographers. The unity of the Continents is there shown, and the text of Willes gives this sweeping description of what was the "conclusion in the scholes,"—"The West Indyes were a parte of Asie. *Quid-*

quid præter Africam et Europam est, Asia est. Whatsoever land doeth neyther appertayne unto Afrike nor to Europe, is parte of Asie."

The "sea carde" of Moletius and the "globes" of Mercator, spoken of by Willes, exhibit the same unity of the continents, and they even extend "the West Indishe lande even to the North Pole, and consequently all passage by sea is cut off that way." The south end of Greenland Moletius "maketh firme lande with America, the north parte continent with Lapponlande and Norway." Subsequently Moletius and Mercator "opened a goulph betwyxt the West Indies and the extreme northerne lande;" but Willes was none the more convinced that a passage was to be found in that direction. "Well," he exclaims, "graunt the West Indies not to continue continent unto the Pole; graunt there be a passage betwyxt the two lands; let the goulph lye nearer us than commonly in cardes we fynde it set, namely, betwyxt the 61 and 64 degrees north, as *Gemma Frisius* in his mappes and globes imagineth it, and so left by our countriman *Sebastian Cabote* in his table, * * * yet doeth it not folowe that we have free passage to *Cathayo*;" and after citing as an illustration the closed Mediterranean Sea, and the fact that the narrow isthmus of Suez blocked the passage from Alexandria to the Moluccas, he thus concludes: "In lyke maner, although the northern passage be free at 61 degrees latitude, and the west ocean beyonde America, usually called *Mar del Zur*, known to be open at 40 degrees elevation, say the Lande *Giapan*, yea 300 leagues northerly above *Giapan*, yet may there be lande to hynder the through passage that way by sea, as in the example aforesayde it falleth out, *Asia* and *America* being there joined together in one continent."

Thus wrote Willes in 1576, when Martin Frobisher was contemplating his first voyage for the discovery of a northwest passage to Cathay, and the accomplishment of the only thing left undone in the world "by which a notable mind might be made famous and fortunate."

But there is much earlier date than that assigned by Willes for the union of Europe and America, and thus, for the connection, at the remote north, of *all* the lands of the northern hemisphere. Europe and America are thus joined on the map of Ziegler, published in 1532. Ziegler's information was no doubt obtained from the data of the brothers Zeni, who, by their long residence on Friesland (Faroe Islands), in the thirteenth century, fully acquainted themselves with Norse geography. The publication of their

records was not, however, made by their descendants until 1558, twenty-six years subsequent to the publication of Ziegler's map, which represents Lapland and Greenland as joined by a coast line that sweeps northward in a great curve. This map is also the property of Mr. Brevoort, and to the same gentleman I am under obligations for a copy of the famous globe of Martin Behaim, drawn in 1492, which was no doubt founded on the same data used by the Italian astronomer Toscanelli, upon which Asia and Japan are marked down after the descriptions of Marco Polo. Here Japan lies in the middle of the sea between the eastern coast of Asia and the western coast of Europe—the sea being studded with islands that are all now familiar to us in fact or fable—the Azores, Antilia, St. Brandan's Isle, Cipango, and the main land of Cathay. Toscanelli and Columbus were personal friends, and it was upon Toscanelli's map, of which unhappily no copy is known to exist, that the great discoverer wrought out the scheme of his immortal voyage.

Upon the map of Orontius Fines, Mexico is placed, as a part of Asia, a little to the east of the river Ganges, and *west* of Cathay (China). The great Pacific Ocean was then unknown. Balboa had not waded into its placid waters; nor had Cortez and Pizarro despoiled the Aztecs and the Incas, and destroyed their kings, nor had they penetrated to the remotest confines of their dominions to look out upon another western water and dream of an Orient still beyond; nor had Magellan and Sebastian del Cano in their worm-eaten, storm-battered vessel, crossed De Gama's track, when John Cabot first set out upon the forty-sixth parallel of north latitude to reach by the north and west the paradise of earthly hopes and joys to which that adventurous age aspired.

Geographical ideas were as strangely confounded in those days as man's ambitions were misdirected. It was an age of fable. Fabulous islands rose in the sea, to sink away again as mysteriously; men of fabulous proportions and shapes were as plentiful as princes with fabulous wealth and splendor; fabulous beasts lived upon the land, fabulous monsters, large enough to destroy whole fleets, inhabited the sea; marvellous influences, powerful enough to draw a vessel's bolts, existed in the Arctic waters; and nothing was too strange or wonderful to be believed in that most credulous time.

The north was especially prolific in those monstrous productions of men's fancies, and the charts of the region are a striking illustration of the fertility of invention which then prevailed. They partook, however, only of the general superstition.

The world was then divided by an imaginary line, running north and south. This was the Pope's celebrated Bull of partition, which split the world like an apple, and with as little trouble. The line ran through the Cape de Verdes, and all new lands that lay to the eastward belonged to Portugal, and all new lands that lay to the westward belonged to Spain.

This was the largest business in the territorial way ever done, and these two peoples, with each a hemisphere for their portion, went forth with the cross in the one hand and the sword in the other, to convert the infidel or to destroy him—in any case to possess his lands. This they called "The pacification of the Indies." The Indian, as every new race of men was then called, had no rights which those fearless, enterprising, and mighty "*Pacificadores*" as they styled themselves, *Conquistadores* as they were in fact, were bound to respect.

When the Pacific Ocean became known, it was discovered that the Pope's Bull had given to the Portuguese Asia, and to the Spaniards America.

Then came the new cry of the South Sea.

The Spaniards and the Portuguese had steadily encroached upon each other's territories. But now other peoples, jealous of the wealth and power which had poured into the little European Peninsula from the opposite ends of the earth, entered the field as rivals for the spoils.

Heedless of the Pope's Bull, and thinking, as the King of France well put it, that it was "something strange the Lord should have forgotten them all in his will," the English, Dutch, and French set up a shout, rather feeble it is true at first, and perhaps a little experimental, but still a shout. To the South Sea, to the South Sea. To India, to Japan, to the Moluccas. To Cathayo. To the East, to the East. Here was their Mecca.

But how was this hope to be accomplished? By this time the American barrier was pretty well defined, and as a barrier to the South Sea was fully recognized. Besides, these Castilian knights had possession of it, and had the power to make their claims respected.

I will not tax your patience with the repetition of so familiar a theme as the multitude of voyages along the eastern coast of America, before the true nature of the coast was determined; before it was discovered that no passage to the South Sea existed by any of the great openings between the St. Lawrence and the Rio de la Plata—none, indeed, until the vast continent should be fairly rounded in the cold regions of the north and south into which it projected.

The Portuguese, who enjoyed their half of the world, and

were growing rich upon it, affected to believe that there was no route to the East,—no passage into the South Sea, except by the Cape of Good Hope, and that America touched the poles. It was a very comfortable belief, but the Spaniards under Magellan disproved the assertion, and the South Sea was opened by the West.

But this did not help the English, French, and Dutch. They saw little chance of rivalling these determined people who had divided the world between them, and for a while, unable to disturb them otherwise, they chose the part of freebooters of the sea, and satisfied themselves with waylaying the richly laden *galleons* of their enemies.

But they were not long content with such uncertain booty. In the general scramble for the possession of the world they must have lands for themselves, and a *route* to India for themselves; and since that to the South was barred by the Spaniard, they sought it in the North. To find this passage became the settled resolution of the northern nations, and the history of this undertaking is the history of Arctic discovery.

In the reign of Francis I. Jaques Cartier entered the St. Lawrence, and returned to report that there *was* a northern Magellan's Strait, and that he had found it. He was rewarded by his king much after the manner Columbus and Cortez had been rewarded before him. But, unlike those two heroes, he had the satisfaction of disappointing an ungrateful master by personally proving the fallacy of his own conjectures.

A new era dawned when Queen Elizabeth came to the British throne, and built up "the wooden walls of England," sending forth her captains to do what they might, encouraging them alike in success and in defeat. With this great monarch the true conquest of America began—not of its people only, and of the riches gathered from the mines, but from the soil—a conquest which planted the seeds of a nation whose growth has been unparalleled in the history of the world, and whose future influence over the destinies of the human race is even now beyond conjecture.

The British adventurer carried with him everywhere enthusiasm for his queen. Remembering the hearty shake she gave his knotty hand at parting; remembering the brimming cup she drained to him on the deck of his own ship; remembering the Godspeed that was wafted after him from her waving handkerchief as he glided down the Thames, he went forth to do his best, and never before nor since was sovereign served as she was served.

It does not concern our present theme to recall the deeds of Elizabeth's great favorites—her Hawkins, her Raleighs, her Drakes, her Frobishers, her Gilberts; I would merely indicate the manner in which the scheme for reaching the Indies by the North was first inaugurated—a scheme which, actually beginning in 1497 with the Venetian Cabot, under the British flag, first becoming an important question, as we have seen, in the time of the maiden queen, was never brought to an end until McClure, under the same flag, at so late a date as 1853, after an interval of three hundred and fifty-six years, proved at length that there was in truth a northern route into the Pacific and to the Indies—a "northern Magellan's Strait" at last; but proving at the same time that the route which he had found was not available for commercial purposes.

How wonderful the changes which have taken place during that time in men's conceptions respecting the regions about the North Pole of the earth! In Cabot's day the North Pole was thought by many to be a huge rock pointing to the Pole star, and bathed by the waters of an open sea. This was, I think, first shown on the "*Universalior cogniti Orbis Tabula*" of Ruysch (which I have from the Society's most excellent and rapidly-increasing library of rare works), embraced in a collection of the maps of Ptolemy revised by Marco Beneventano, and published at Rome in 1508. Ruysch's plan of the North was subsequently modified by Orontius Fines, on his heart-shaped map, to which I have previously alluded; but, on both maps, at the four quarters there were four vast islands, between which flowed four great rivers, and these rivers drained the superfluous waters of the ocean into a great basin about the Pole, whence they plunged wildly down into the innermost abysses of the earth. These four islands were fertile, and possessed a salubrious climate, and at least one of them was inhabited by a race of pigmies, who, descending sometimes to southerly latitudes, created an infinite deal of mischief. On the maps of the time of Charles V., these four islands and four rivers are marked down with great exactness by the highly imaginative cosmographer of that celebrated monarch.

About the year 1588 these picturesque conjectures were somewhat disturbed by the appearance of one Lorenzo Maldonado, who, having got into the Pacific Ocean, claimed to have entered from that side the fabulous "Straits of Anian." This strait was first suggested on the globe of Schöner,

and was founded, no doubt, upon a faulty reading of the name *Mar Usiano*, which bounded the New World on the North, as shown with much exactness in the Ptolemy of 1513. It was more elaborately drawn afterwards by Moletius and Mercator, and was soon firmly believed in; and therefore Maldonado was readily credited when he declared that he had sailed all the way through the strait to the Atlantic Ocean. He forthwith proceeded to offer his information for sale to the English; but when the eager purchaser came forward ready to exchange the pay for the pilot, the pilot had disappeared, having discovered that he must first lead the way.

The same fortune befell the Greek De Fuca, a few years later. Sailing up the coast of California, De Fuca, then in the service of Spain, discovered the coast to trend suddenly to the eastward, and upon his return he offered the information in the same quarter as Maldonado had done before; but the wary Englishman had no mind to purchase the prize before he had it in his keeping. So the disappointed adventurer went to Mexico and died.

A friar of considerable celebrity at that time, on account of his travels, by name Andreas Urdaneta, was reported to have accomplished this great journey between the oceans, in a ship; but he does not appear to have profited by it more than the others. I mention these incidents merely to show how deeply the public mind was occupied with that quarter of the world.

Throwing aside these fabulous accounts, let us now review the actual field of discovery. In order to do this with the least loss of time, I will reverse the course which I have hitherto pursued; that is to say, I will temporarily skip over a period of three hundred years, and briefly illustrate the present state of Arctic geography.

The diagram on the wall (drawn after the recent and most excellent chart of Dr. Heinrich Kiepert) represents the Arctic regions in circumpolar projection. It exhibits a broad ocean about the North Pole—an ocean, however, without the islands and the rivers and the tumbling waters of the inventive Frenchman.

This ocean covers an area of nearly four millions of square miles, almost equal in extent to the whole continent of North America. It is closely invested by land throughout the greater part of its extensive circuit, and it forms one of the great Basins of the earth. Into it pour the waters of the river sheds of Northern Asia and America, among the largest

in the world—the former equalling 3,500,000, the latter 800,000 square miles. Its currents are a part of the great system of ocean currents in which the restless waters of the globe are ever moving, and through this agency and that of the discharging rivers, the region about the Pole is tempered with a warmth not otherwise natural to it, while in the same proportion the chilled waters, returning to the South, soften the equatorial heat; and in this we behold a sublime illustration of Nature's wise and beneficent law of compensation.

It will not be amiss for us here to pause a few moments that we may trace these currents so far as known, and I will ask you again to follow me around the globe, that we may get the key to our position—not, however, this time in the track of the Spaniard, but in the track of Nature, whose ways are always ways of pleasantness, if her paths, when one is pursuing them, are not always paths of peace.

And let me say here, that I do not offer an apology for the elementary nature of my observations, for I have not assumed to read a paper descriptive of new discoveries, nor to give any elaborate discussion of scientific principles, but to present a new grouping of well-known events and recorded facts.

Let us then start in the Indian Ocean. Here, in the neighborhood of Borneo, in the zone of the "Southeast Trades," in the region of the monsoons and hurricanes, we find the great body of the waters of the ocean having a westerly flow. This flow is interrupted by the coast of Africa, which deflects a portion northward, but sends the main current southward through the Mozambique channel. Reaching the Cape of Good Hope, it enters the Atlantic as the Cape Current, whence it follows the general direction of the west coast of Africa, until it assumes again a westward course as the great Equatorial Current of the Atlantic. Splitting now on the east coast of America, a part of it enters the Caribbean Sea and Gulf of Mexico, and originates the Gulf Stream. The other part, as before seen on the east coast of Africa, is carried south and west, and around Cape Horn it joins the Antarctic drift, and once more becomes the great Equatorial Current in the Pacific Ocean. Meeting Asia, the Japanese Current is deflected northward, and the main body of the stream, flowing on westward through the Molucca Sea, passes Borneo into the Indian Ocean, whence we first set out to trace the flow of waters—a flow which, varying in velocity from five to one hundred and twenty miles in four and twenty hours, would, in two years and ten months, carry a

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dismasted ship or other floating object, uninfluenced by the winds, once around the globe.

Two points of this great artery of the ocean concern our present discussion; these are the Gulf Stream and the Japanese Current, which, breaking away from it and the tropic heat, plunge at length beneath the ice canopy of the Arctic seas, and are lost to observation in the unknown region round the Pole.

To a certain point we can, however, trace them with certainty.

The Gulf Stream—the great current of the North Atlantic—follows the east coast of North America until it meets the cold current from the north, where it is pressed out into the middle of the North Atlantic Basin, and in mid ocean sends off a branch to the Azores. Continuing thence northward beyond the latitude of Iceland, it touches Norway, and enters the Polar Sea.

The Japanese Current pursues the same course in the North Pacific. Throwing off a branch below the Aleutian Islands (which flowing southward tempers the climate of Sitka and Oregon), it continues northward through Behring's Strait, and like the Gulf Stream of the North Atlantic, enters the Polar Sea, and is lost among the ice.

Of the flow of the waters within the limits of that Polar Sea we know comparatively little. We trace, however, one great current outward from its unexplored depths. This sweeps along both coasts of Greenland, the branch on the eastern side, after touching Iceland, wheels around Cape Farewell into Baffin Bay, where it joins the other branch that sets through Smith Sound, and out from the great Parry Archipelago through Jones Sound, Lancaster Sound, and Hudson Strait. Thus uniting its various arms, this great Polar Current pursues its course, freighted with ice, along the coasts of Labrador and Newfoundland, wedges itself in between the Gulf Stream and the American coast, and is not finally lost until it has spread its benign influence over the neighborhood of the Gulf of Mexico, making habitable, regions which would otherwise be the hottest and most pestilential in the world.

Following the line of these two Currents, we observe a most remarkable difference in the conditions of the surface water. While the one is cold, and dotted with ice fields and icebergs, which drift sometimes as low as latitude 43°, the other is comparatively warm, even beyond the Arctic Circle, and but little ice is met until we have reached latitude 78°—35°, or 2,100 nautical miles nearer the Pole than in the line of the Polar Current.

It is interesting to trace the parallel influences of the Gulf Stream and the Japanese Current upon the western coasts of Europe and America—tempering their climates to much the same degree on either side.

On the Atlantic side we find the flourishing city of Glasgow, in latitude 55° 51′, parallel with the most cold and desolate parts of Labrador, which is chilled by the ice incumbered current of Baffin Bay. The populous city of St. Petersburg is in the same parallel with Cape Farewell, the southern point of Greenland, in latitude 59° 56′. The famous city of Elsinore is in latitude 56° 02′.

On the Pacific side we find Sitka, in latitude 57° 03′, with a similar climate to that of the European cities before mentioned; or rather we might say with the winter of St. Petersburg and the summer of Padua.

Thus does the Gulf Stream, freighted with tropic warmth, carry a soft and pleasant climate to the British Isles and the lands bordering the Baltic Sea, and even to the coast of Norway, while the Polar Current of the other side of the Atlantic Ocean, freighted with ice, brings to the lands in the same latitude (those of lower Greenland and Labrador) chilling frosts and a climate that is endured only by a few hardy fishermen and fur-clad savages, who draw no subsistence from the soil. So great, indeed, is the influence of this Polar Current upon the one shore of the Atlantic and of the Gulf Stream upon the other, that before we have found on the eastern slope of the Alleghanies a climate as temperate as that of Elsinore, we have descended from the north almost to New York, which is in latitude 40° 43′.

These facts are of course not new, but it is well to refresh them in our minds, for they have not only an important bearing upon the value of our recent acquisition of Alaska, but are directly connected with the subject which we are at present considering.

It would almost seem certain, from a casual observation of these physical conditions, that the line of the Gulf Stream should be the most feasible route to the North Pole, and yet experience proves the ice barrier to be more impacted there than in any other quarter.

For a time it was indeed more favorably regarded than the route by the northwest. In this direction lay the "*Cape Tabin*" of Pliny—the northern Cape of Asia—the northern Cape of Good Hope; and here it was thought must surely lie the northern Magellan Strait. But the disastrous voyage of Willoughby caused the English to abandon the

effort to penetrate in that quarter, and the Dutch who succeeded them, in the unhappy death of Barentz, and the destruction of his ship, lost the bright hopes with which they had assumed the undertaking.

On the other hand, the sea immediately to the west of Spitzbergen became a general favorite. Here they would find the Strait. Here they penetrated to higher latitudes than in any other quarter. Here sailed many of the most noted mariners of their time, confident of finding the passage. Here Hudson reached to latitude 80° 30′, and Scoresby to 81° 30′. Here Phipps, Clavering, Sabine, and Buchan, and Franklin, have gone and fought against hard fortune; and here Parry, with, as has been well said, "a daring unequalled in the history of personal adventure," boldly struck out upon the Polar Sea with boat-sledges: but the ice becoming loosened with the advancing season, he was carried south by the Polar current two miles a day faster than he was travelling north. He was then in latitude 82° 45′, nearer to the Pole than, according to any well-authenticated record, any one had reached before, although many whale fishers have declared that they have sailed on and on without meeting ice, even to the very Pole itself. One stated that he had sailed two degrees beyond it, as recorded by Daines Barrington, and another enterprising Amsterdam whaler declared that he had sailed twice around it.

This was, indeed, for a long time, and is in some measure even to the present day, one of the most important whaling and sealing grounds in the world. In the early part of the eighteenth century the whaling fleet numbered from three to five hundred sail. In like manner Baffin Bay became similarly noted, and thus was added another powerful motive to Arctic discovery, and to the daring whalemen we are indebted for much valuable information.

It was into the Spitzbergen Sea that the German and Swedish expeditions made their way during the past summer; but their fortune does not appear to have been materially different from that of their predecessors. The details of these spirited voyages have not yet reached us, and we await their last published reports with much interest. It would appear, however, from the preliminary report of Captain Koldewey, commanding the German expedition, that he made important explorations on the north side of Spitzbergen, and reached to latitude 81° 05′, longitude 16° east, finding heavy and impenetrable ice. I have not yet met with any official statement from Prof. Nordenskiöld, of the Swedish party.

The attempts which have been made to find a passage from the Pacific into the Atlantic by following the course of the Japanese Current, have been attended with the same fortune as those by the Gulf Stream; and even after Behring had discovered the strait which separates Asia and America, there was little known of the coast lines to the east and west of it until they were approached from the land; and it was therefore not until then that there was any rational conception of Arctic geography, or of what was really attempted when men sought to pass the northern capes of Asia and America, and find there the strait which was to lead to wealth and fortune.

Prior to the time of Behring, however, geographers had some vague knowledge of parts of the north coast of Asia. Here the audacious Cossacks, fighting their way through hostile tribes from the Ural to the Yenissei, to lay tribute on the refractory Samoiedes, finally came upon the ocean and disclosed the wealth of mammoth ivory in the "ice cliffs" of the Siberian coast. This was about the year 1610. Merchants and hunters following after them, the Lena was at length discovered, and finally the entire coast of northern Asia was explored, chiefly in the interests of commerce and trade, either by means of dog sledges over the ice in the early spring, or in boats during the summer along the land lead caused by the melting of the ice in the floods of warm water which pour down into the Polar Sea from the watersheds of northern Asia.

In this direction it was that Baron Wrangell and Lieut. Anjou performed the most remarkable sledge journeys on record. The first named, by his published narrative, gave the first clear insight to the nature of northern Siberia, and to the Polar Sea beyond, and from this quarter were gathered, by this Arctic Hercules, golden fruits for science.

On the American side Hearne was the first to reach the sea. Following the Coppermine River he looked out upon the great Polar water in 1770, and opened the way for Mackenzie, Franklin, Richardson, Back, Rae, and others, whose explorations finally delineated the shore line from Behring Strait to the Atlantic.

The boundaries of the Polar basin were thus in a general way defined, thanks to the Cossacks and the gallant Hearne, who, following at the same time their own inclination and the river's course, opened to view extensive regions, habitable by man and useful to commerce.

If to Hearne we owe our first glimpse of Arctic America, to another gallant man we owe the chance which gave it to us,

for to him is the world indebted for the record of Hearne's heroic journey. This record was in the shape of a report in journal form to the Hudson's Bay Company, of which Hearne was an officer, and to a "pigeon hole" (where in all countries many good things go along with many bad) at headquarters, called Fort York, it was consigned, and there it lay for many years. The fortunes of war found the famous and chivalric French Admiral La Perouse in Hudson's Bay, and Fort York was one of his bloodless captures. La Perouse was a scholar and a gentleman. He ransacked the governor's papers, and found Hearne's journal. He read it, was charmed with it, and forthwith he told the powerless officer who had hauled down the cross of St. George before the Oriflamme, that if he would pledge his word and honor as a man to have poor Hearne put in print, he might have flag, fort, and all back again into his keeping. Such easy terms were never before accorded by conqueror to conquered, and the astonished British Governor, glad to be rid of the French Admiral on any terms, without further loss of time subscribed the conditions, and Hearne became immortal.

Such at least is the story as we have it on the word of Albert Gallatin.

The Arctic coast lines of Asia and America being once determined, the interest became centered in the two great groups of islands lying north of the continents. The one belonged to Russia, the other to England. The former soon explored the New Siberian group, but they failed to reach the traditional "Polar Land" beyond. They were invariably arrested by an open sea, as described by Baron Wrangell, "illimitable to human vision." This open water extended in a southerly and easterly direction towards Behring Strait.

But the greater interest was felt in the English quarter—in the region where Arctic discovery first began—in the northwest. Here was made the first zealous search for the northern strait, and here were lives hazarded without number, and here, if a commercial route was not finally discovered to the Indies, the northern half of a continent was at least reclaimed to civilization.

Going back to a period anterior to the time of Columbus, we find the Northmen in possession of Iceland and Greenland, and they had clearly touched the American continent early in the eleventh century. How far they penetrated, or how long they occupied the country—what was their "Markland," and what their "Vineland," are questions, Mr. President, of which I will not attempt the discussion in the pres-

ence of one who has devoted so much attention to the subject as yourself, and who is so much more competent than I am to enlighten the Society.

Nor is it needful for me to dwell upon the vague and uncertain conjectures respecting the "St. Brandan's Isle" of the roving Irish monk. Was it the "*Terra Nova*" of the Cabots—the Newfoundland of the present day? Nor will I detain you with any discussion of the various conjectures respecting the progress, in the same direction, of the Basque fishermen. Whence they went, and by what course, no one knew but themselves, and since interest is always a safe lock upon a secret, they kept theirs well. Long before the world was popularly considered to be round, long before Columbus was born, this hardy race of men brought "*bacallaos*," that is, *stock* or *stick* fish, from some mysterious place in the West. Was their "*Terra de Bacallaos*," the "*la Terre de Morues*" (the land of codfish), the "*Kabeljavland*" of Cabot's day; the land which, at a later time, rich in wealth gathered from the sea, enticed Europeans to America, and opened the way to the discovery and occupation of Canada?

Nor need we linger over the discovery and the mysterious disappearance of *Friesland*, nor of the voyage of the Cortereals to Labrador, of Davis to the great strait which he discovered, of Baffin to the great bay beyond, which he circumnavigated; nor of the romantic hopes of the King of France when Cartier had reached "*La Grande Baie*" and the "*Ile de Bacchus;*" nor of the equally romantic project of the "Sovereign of the Seas," when her favorite Frobisher brought home his story of the "*Meta Incognita*," where was the turning cape at last, and on which she would forthwith plant a fort to protect the now certainly discovered strait leading to the Indies, from the use and occupation of all her enemies and rivals whatsoever.

But I would invite your attention for a few moments to events of a later period, within our own time and century; to the voyage of Ross, which proved Lancaster Sound to be crossed by the "Croker Mountains;" to the voyage of young Parry, who proved the Croker Mountains to be another Arctic fable, and who sailed into the middle of the great archipelago, half way through to Behring Strait; to the voyage of Franklin, which, performed in the two ships, Erebus and Terror, came so near accomplishing the northwest passage before the evil-omened vessels and their captain and their crews were sent by the Arctic frosts to death and immortality. And I would refresh in your minds, also, the memory of the great

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developments in Arctic geography made by the men who have gone in search of this last of the expeditions for the discovery of the northern Magellan's Strait—of men who, by their conduct in that chivalric enterprise, have made their names familiar to our ears; of Collinson, who entering from Behring Strait, almost met the track of Franklin from the east; of McClure, who finally made the passage; of Austin; of Kellett of the Resolute; of Inglefield, who was the first to enter Smith Sound; of Kane, who, following upon his track, reached the open sea; of Sherard Osborn, who has written so charmingly of Arctic scenery and adventure; of chivalric Bellot; of scientific Sutherland; of our own sturdy De Haven; of Ommanney and Anderson; of McDougall and Mecham and Pim and Richards; of Hall, who had brought the last developments of Franklin's fate, and of others equally conspicuous, by whose united efforts an extensive region has been opened to science. The great group of islands lying north of America has been mainly explored, and at a later period I had the good fortune to trace the land still further northward—nearly to latitude 83°, until, like the Kotelnoi of Wrangell, it was shown to project into the Polar Sea itself.

This land is the most northern land at present known, and I hazard the opinion that it is, as Dr. Petermann has styled it in his elaborate paper in the January number of the *Geographische Mittheilungen* for 1867, "*Das nördlichste land der Erde.*" First discovered by me in 1854, in the expedition of Doctor Kane, it was then named, and is now known as Grinnell Land. Subsequently I revisited it in 1861, and then, during a long and laborious sledge journey (a journey of not less than 1,300 miles, performed on foot, with dogs to drag our stores on sledges, over the ice of Smith Sound, and prolonged through sixty days, with temperatures sometimes as low as 60° and 68° below zero, and without other shelter than a snow-hut), I penetrated, as it were, into the very heart of the Polar Basin.

And here we have reached the very point of all Arctic questions—the open Polar Sea.

And here rests Arctic discovery. Here ends the romantic record of three and a half centuries. That immense region around the North Pole, over which we have gone in this hasty flight, coming first into view in an ambitious age, has been gradually unfolded through the efforts of men acting mainly, as we have seen, in the interests of commerce. But commerce has at length abandoned the fight for a track across the globe. She sees no new fields or products to

grasp in that direction, and patient Science sits upon her neglected seat, and is left to do alone what yet remains. She has done much in her own quiet way already, and she will yet do all. And there is yet much to be accomplished.

I have spoken of the open Polar Sea—as a fact and as a fable—as it was pictured several centuries ago, and as it is known at the present time. The fable need not be disproved; nor need the fact be proved. It is established. The observations are conclusive, and they are so generally familiar that I have not thought it necessary to detain you with a discussion of them. That such an extensive area of water should be frozen would appear to be impossible, even without other evidence than an ordinary acquaintance with the phenomena of nature. Water is a restless object. Lightsome and limpid, it treads the earth or mounts to heaven, and its natural state is one of incessant change. When the evening shades are coming on it leaves the floating air and nestles through the night upon the gladdened leaf; with the early flush of morning it melts away upon the first returning sunbeam, or steals to earth and seeks the fountain and the brook; and when the winter frosts threaten it, then it flees before the danger in the rivulet and rolling wave.

Firmly frozen bodies of water of any considerable extent are not known. Baffin Bay is never closed; Hudson Bay is as open at its centre in midwinter as in July; the coast of Siberia is lined with a narrow belt, while all beyond is open; and even Baffin Bay in its upper part, which, as the "North Water," may be regarded almost as a separate sea, is never closely sealed: there is much drift ice in the summer, though little fixed ice in the winter. Upon its margin I passed the winter of 1860–61, and there, even at forty degrees below zero, we were always within the sound of the beating surf. So persistently, indeed, did this water refuse to close up, that, until the darkness of the winter had passed away and March had come with the sunlight and the greatest cold of all the year (68° below zero), we were kept close prisoners within the bay where we were harbored—the troubled waves breaking incessantly upon the capes on either side.

The waters of the Arctic Ocean, moving continually in currents from south to north, and from north to south, are kept at a general temperature above the freezing point, and the ice forms only where the waters are sheltered by the land, and are not in motion; and it is a fact worthy to be borne in mind, that the deep sea water preserves throughout the world an almost uniform temperature, little removed from 40° Fah-

renheit's scale, while the surface water partakes more or less of the temperature of the air. That is, while in the tropical regions the surface water has often a temperature as high as 88°, in the Polar regions it is usually at the freezing point of sea water, 28.75°, seldom rising much above that degree.

It follows, therefore, that the general reduction of temperature of the air as we approach the North Pole is disturbed by local causes. The system of isotherms, first projected by Baron Humboldt to the thirty-second degree, show a wide deflection towards the Pole in the line of the Gulf Stream and the Japanese Current, thus indicating that within the northern hemisphere there are two great centres or Poles of cold, nearly equidistant from the geographical Pole. One of these Poles of cold is about the great group of islands to the north of America, among which the ice is gathered, thus keeping the warmer water from contact with the air; the other is about the new Siberian group above Siberia. Towards this milder region about the Pole—milder because of the open water that is continually there—the water fowl take their flight in the breeding season, and in the same direction the whales migrate in search of fresh feeding grounds.

Keeping the eye upon the coast line which invests this great Arctic Basin, we trace with it an ice belt along the coast of Siberia to Nova Zembla, from Nova Zembla to Spitzbergen, from Spitzbergen to Greenland, from Greenland to and among the islands north of the American continent, thence along the American coast and across Behring Strait back again to Siberia—a continuous land clinging belt within which lies the open sea—that myth of ignorance and wonder of wise men, the sea of fable and of fabled story, against whose barrier all the ingenuity and arts of man have not prevailed. The beasts of the sea and the fowls of the air seek it, safe there from man's pursuit; and, to this time, useless for all man's purposes, its tumbling waves beat and break against the ice-girt shore in undisturbed seclusion now as when "the morning stars first sang together, and all the sons of God shouted for joy."

> Great wondrous sea! till now thy broad waters blue
> No man made keel of ship ere yet has plowed;
> Ice-ribbed and unapproachable art thou,
> Heedless of all the threats that man has vowed
> To break thy barriers down. And he has bowed
> Before thy prowess. Fearful of thy fame,
> Backward hurled, he hears thy triumph loud
> Proclaimed, and owns his efforts weak and tame
> Compared with e'en thy feeblest terrors, that his proud ships doth maim.

Along thy adamantine walls are piled
His wrecks, like ghostly sentinels, to say,—
"Thus far, no farther! By these waters wild
There is no traffic for the world. A way
Cannot be found where'er this sea doth sway
The fate of empires, in their commerce free.
By north, by east, by west, by every way
The path is closed, and here we lie." Great sea!
We hear thy shout of triumph on the frozen wall:—"Victory!"

Shall the victory remain with the sea, or shall it remain with us? Shall we not make one more effort to plant over it the standard of our science, to wave over it the flag of our country? Shall we not woo once more this Penelope of Oceans? The time is favorable. The sea is not less formidable, it is true, nor yet less fickle than it has ever been before, but we have learned much by experience, and I am fully persuaded that these Polar waters may be navigated.

To that end, as you have seen, there are four routes. Without here entering into an elaborate discussion of the reason therefor, I give the preference to that by Smith Sound. My views are in this respect in no way changed, but rather they are confirmed by events. I give this simple enumeration of its advantages:

1. Land as a base of operation.
2. The opportunity to colonize a party of hunters and natives as a permanent support.

A glance at the map will show you how important is the first of these elements. The second requires a further explanation:

The colony was, indeed, the key to the plan which I had proposed for 1862. Had I been able to return that year, I would have started with two vessels, one a small steamer, the other a sailing vessel, as a store ship. Pushing through the "middle ice" of Baffin Bay, I would have steered for Port Foulke, my old winter harbor, at the mouth of Smith Sound. Here I would have secured the auxiliary vessel, and remaining only a sufficient time to see the natives gathered together, and the wheels of my little colony set in motion, I would have sought the west coast of Smith Sound with the steamer, and through the land leads have worked my way to the Polar water. Failing to accomplish this the first season, I would have secured a harbor for the winter, and pushed on the work as opportunity offered. Failing altogether (in the event of finding the ice too closely impacted at the head of Smith Sound to admit of a passage), I would still have secured my object, for with a provision depot now within six hundred

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nautical miles of the Pole, with the colony at my back, and in the winter readily accessible, with dogs breeding there, furs and provisions accumulating, I would have overcome the obstacles which embarrassed me in 1860–61, and which had embarrassed Dr. Kane before me. Once in this favorable situation, I would have brought up my available strength from the colony, and in the early spring have put out depots of provisions along the line of Grinnell Land, and following them up with a boat mounted on runners, I would then have sought the open water and the Pole.

Such was my plan seven years ago. It is my plan to-day. I believe it reasonable, and experience convinces me that it is practicable. I even believe that the chances are greatly in favor of the success of the first part of the scheme—that is to say, that the ice belt can be penetrated with the steamer, the open sea navigated, and Behring Strait and the Pacific Ocean reached.

The plan which I have thus sketched does not (with the single exception of the proposed colony) differ materially from the plan which I laid before you eleven years since. But the expedition with which I actually took the field, was by no means what my fancy had originally painted it.

Instead of the two vessels which were at first proposed, and one of which should be a steamer, I was forced to content myself with one small schooner, and to start without the much needed steam, the lack of which cost me the main purpose of the voyage, for I have no hesitation in saying that with a steam vessel I would certainly have reached the Polar water and the North Pole in September, 1860. But public opinion at that time was much opposed to the further risk of life in that much maligned region, and the few of us who stood together for the voyage at every hazard, in concert with our friends in Boston, Philadelphia, Washington, and Albany, had to own that we could do no more than fit out the little schooner; and therefore the expedition became like the German expedition of the past summer, in some sense, experimental. The advantages, however, which were gained by the experiment, were in a measure lost by the war which having broken out in my absence, prevented my return north in the spring of 1862, by claiming my services in a quarter which then occupied the hearts and hopes of every good citizen. I have not since been able to gather up what was then lost and scattered, and complete what I had begun.

You are aware, from reports which I have hitherto made to the Society, that we were unable to penetrate the Smith

Sound ice with our sails alone; but, as I have stated a few moments ago, with dog sledges over the ice in the spring, we reached the most northern land on the globe; and tracing it to a point of latitude beyond that of any previous exploration, we stood upon the shores of the open sea which we overlooked, and we set up our flag and cairn only five hundred miles from the North Pole. The position was one, therefore, valuable for observation, and my conclusions are founded upon what I have seen and experienced. These as I have said lead me to prefer this route. But the others are certainly not without their peculiar attractions.

Next to the route by way of Smith Sound I should, in some respects, give the preference to the route by Behring Strait. Fitting out at San Francisco, and starting finally from our new territory of Alaska, I would enter the strait and steer north and west in the wake of the whales and whalers, who are always sure to know where to seek the open water.

But this route has neither of the advantages to recommend it that I have urged in favor of Smith Sound. The hitherto impenetrable ice-belt comes down lower there than at any point of the whole Arctic circuit, and there is not likely to be found any land that would serve as a base of operations for a continued and extended exploration. The Behring Strait route has the support of a distinguished name—that of General Thomas L. Kane, who ably set forth its advantages in his instructive paper on Alaska, which he read to us some months ago, and it is by this Behring Strait route that M. Lambert proposes to conduct the French expedition now, as I understand, vigorously preparing. It is also advocated by Captain Silas Bent, U. S. N., in the letter you have favored us with, Mr. President, in the opening address, to which we have all listened with so much pleasure and profit, not, however, unmixed with sadness at the announcement you have made of the death of one of the great lights of Geographical Science (M. de la Roquette).

Captain Bent formerly communicated to the Society some valuable observations respecting the Kuro-Siwo, or Japanese Current, of the North Pacific Ocean, and, independent of his abilities, his position as chief hydrographic officer to the expedition of the late Commodore Perry, entitle any opinions which he may express to high consideration.

On the opposite side of the Pole from Behring Strait, and ten degrees nearer to it, we find in the Spitzbergen Sea, much

the same conditions that exist above Behring Strait. The eminent geographer Dr. Petermann is, I believe, now refitting his expedition with two steamers to return by that route to the ground it occupied the past summer; and since there is no nationality in science, we can certainly all unite in wishing him the success he so ardently desires, and to the attainment of which he has devoted so much time and energy. But it seems to me that the grounds upon which he bases his expectations are somewhat arbitrary. He projects Greenland entirely across the Arctic Ocean, and he puts Captain Inglefield, Dr. Kane, and myself in a *cul-de-sac*, quite regardless of our reports that there is a strong current setting south through Smith Sound, and that open water makes from the north, as I have personally observed—neither of which events could possibly happen did not Smith Sound lead into the Polar Ocean. So rapidly indeed was the open water making from the north in May, 1861, between latitudes 81° and 82°, that I was forced to the land, and escaped with my party, not without having encountered serious risk.

Much has been said of the fourth route—that to the east of Spitzbergen—between Spitzbergen and Nova Zembla. But to my mind this is the least favorable of them all, independent of the failures which have resulted from following the current in that direction, and of the probable fact that extensive lands, beginning with the unexplored Gillis Land, lie to the north and east. And this brings me once more to the discussion of the principle which must be kept in view in the conduct of this Polar enterprise, from whatever point it may be undertaken.

It is much a question of ocean currents. Follow the ocean currents has been often urged. Follow the Gulf Stream toward Nova Zemble, says one; follow the Japanese Current through Behring Strait and beyond says another. This looks reasonable on paper and sounds well, but the evidence is against it. The truth is, this is precisely what ought not to be done, and it is what never has been done successfully to any considerable extent, in the whole history of Arctic exploration. It is, indeed, by following precisely the opposite course that we must look for success.

The closest approaches to the Poles by water have been by way of Spitzbergen. Here the polar current comes from the north and east, and Spitzbergen gives a lee along which vessels can make their way almost any year as far as latitude 80°.

In like manner the Polar Land to the north and west of

Behring Strait furnishes a similar lee, for there the current is from the north and west. There are thus many points of resemblance. Both present deep breaks in the ice-belt; both are favorite whaling grounds; in both the whales are seen to go north; in both whales have been caught with harpoons in them which they had carried from the opposite side of the Pole; into both have whale-ships gone until they could see no ice—until they were sailing into an open sea—in the one to 81° or 82°, in the other to 72° and 73,° or perhaps even further. In the latter quarter the Massachuetts whaler of New Bedford, in July, 1866, sailed to 72° 30′. Her course was to the west of the Herald and Plover Islands. The Polar Land lay to the left as the vessel sailed northward, and was distinctly visible; and in this connection I will observe that this Polar Land is familiar to most of the whalers who go to that sea. Captain Long has become noted for sailing nearer to it than any of his predecessors. It would seem to be an extensive island.

In this same direction several Government expeditions have sought an entrance, but they were, with one exception. unable to penetrate beyond 72°. Here Cook was driven back at 70° 43′; Beechy at 71°; Kellett and Moore at 72° 51′, seeing "water-sky" beyond, but impenetrable ice around them; and the same fortune befell the able and distinguished commander, Captain John Rodgers, of the U. S. Navy.

Here let me remark, also, that to the eastward from Behring Strait there exists much the same condition of things that exists in the sea towards Nova Zembla. In both cases the current sets to the north and east; in both cases is the ice closely impacted; in neither case is there the least chance of success. Collinson and McClure made their way eastward, it is true, in this direction, but it was by keeping below the ice-belt, through the leads which make in the summer there as along all Arctic lands.

And now let me assert one more dogma as part of the general proposition. A successful prosecution of this exploration must be in the direction against the current, and towards the point where the open water makes from the northward; where the land gives you holding ground; where the ice drifts past you; where hope lies ahead; where the enemy sets, not with you on your track, but behind you; where a field of ice when once passed is rid of.

Such a route we have in Smith Sound—once more land to give a lee (Grinnell Land); once more a southerly drift; once more open water making to the northward. I will

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say no more, nor need I recite to you the advantages to science (more than in any other Arctic quarter) which would accrue from a prosecution of this line of discovery—the determination of the limits of this most northern land upon the globe, of the unexplored coasts of Greenland, of the great glaciers in that region; and, indeed, in almost every department of physical science, the Smith Sound colony would furnish the means for obtaining valuable materials. There is no locality like it along the boundaries of the unexplored Polar region, independent of all question as to its availability as a route to the Pole or to the Pacific Ocean.

As before stated, it was here that I passed the winter with my party in 1860–61, and subsisted them almost entirely by the hunt. Reindeer, foxes, seals, walrus, and in the summer birds, were very numerous, and we were never a single day without fresh food. Thus was the scurvy, so often incident to wintering in the Arctic regions, wholly avoided, and on board our little schooner *United States* there was never a "sick list" from the time of leaving home to our return.

I would establish my party again in the same situation as before, and then at Port Foulke I would build up the little colony. The natives are friendly, and could be made serviceable. Dogs could be reared to any extent, and the great numbers of walrus which might be captured with ease, would furnish them abundant subsistence. Annual communication could be had with home, and the products of the colony might indeed be made to bear no inconsiderable share of the expense of the exploration. This expense would not, however, be so great as is generally supposed. The two vessels furnished, they could be fully manned, the one with fifteen and the other with twenty-five persons, and maintained in the service during two and a half years for $40,000: this would include provisions and wages, allowing the full navy ration, and the ordinary pay for officers and men of the merchant service.

I think I have stated enough to show the strength of footing upon which such an expedition would stand. There is no dislodging it. Founded upon the colony it may last for years. It is in a great measure self-sustaining. It will furnish a home for as many scientific explorers as wish to avail themselves of its advantages for years to come. It insures safety to the effort at the North towards the Polar Sea and North Pole in the event of disaster; and it insures that one disaster is not necessarily fatal, and does not necessitate the abandonment of the field and a return home, as was my own

case in 1860, and has been the case with every expedition that has gone before me during these past three hundred and seventy years.

I have said that I did not propose to advocate a cause, yet I cannot conclude without expressing a hope that the scheme which I have thus set forth may be carried out. I would wish to see it done under the American flag; I would wish to see that flag planted at the Pole before another country steps in to take from us the glory of priority—the prize for which we have striven. I would like to see the northern coasts of Greenland and Grinnell Land fully explored, and the boundaries of the great Polar Basin thus fully defined. We would all wish that there might no longer be a *mare incognita*, nor a *terra incognita* in that region of mysterious influences and mysterious climate—we would know the currents of the one and the character of the other, the magnetic forces, the temperatures and tides. I am no less earnest than formerly for the opportunity to conduct the expedition that would accomplish these results myself, and once more to try conclusions with my old foe the Smith Sound ice.

Our Government is not one upon which we usually rely in such emergencies; and yet I have thought the Government might now be persuaded into lending us a good, stout ship, of the many not in use. A noble little vessel with a noble history has been offered me by her public spirited owner, if I will bear the other part of the expense. This would be the very luxury of Arctic cruising—a craft under one's feet to be proud of, and whose gallant behavior on a memorable occasion, would of itself inspire confidence; but it would, as I know from former experience, be a rather expensive luxury for a personal enterprise, and the day has gone by when travellers pick up stray Incas, and squeeze golden ingots out of them by the room-full. The Arctic regions present no very conspicuous temptations of that sort, and for this reason no doubt it is, that the question as to the utility of these Arctic expeditions is often raised. The question is perhaps not unreasonable. But it is asked I think without due reflection. For he must be a bold man, who, with the history of discovery and invention before him, will now say, that any patient effort or honest work done anywhere, however obscure the result may be, is *useless*. "What good?" is a question often put, and had it been always heeded, Columbus would never have crossed the ocean, nor would Fulton have built a steamboat, nor would Morse have set up his telegraphic

poles; nor would we now profit by the patient labors of Newton and Watt and Volta; nor would the famous merchant princes of various times have stirred from the even tenor of their ways:—Berardi of Seville would not have sent his clerk Amerigo (with a name ready coined for a continent) to see what he could find in the yet unprofitable west; nor would La Maire have equipped, at his own expense, the expedition which was to fix his own name at the southern extremity of America; nor would Felix Booth have sent out Ross to gain for him America's most northern cape; nor would our own much honored merchant, Henry Grinnell, have sent his young friend Kane upon a service that was to result in the most northern land of all the earth being given to him as a monument forever.

In truth, the world has profited most by those discoveries and those enterprises which possessed at the outset only an abstract value, and had little interest to anybody except the learned and curious. "We cannot know what we have never tried." We cannot even yet assert that a ship may not be steered from the Atlantic to the Pacific Oceans by the Northern Sea; nor that our material interests are not directly concerned in reaching the North Pole of the earth.

But I plead the extension of our knowledge in that direction, solely because I plead for Science—fair and bright goddess, who with steadily increasing power has led men to fields of gain and usefulness by peaceful ways; who has her devotees and makes them useful—her Pizarros, her Cortez, her Magellans of a better time. She has upheld our Christian faith, and has made fruitful places for the Christian cross. With the traveller and the missionary she has been always present, smoothing their pathway, and opening the gates before their march—supporting them in adversity, consoling them in distress, counselling and instructing always. By the lonely watch fires of Livingston; by the weary couch of Baker; by the chilly bedside of Parry, on the Arctic snows; by the jungled shelter of Humboldt; by Du Chaillu's tent among the savage beasts and scarce less savage men of the Ashango Land, she has been an ever faithful sentinel, as she has been an ever faithful guide to Xavier in the dangerous places of Japan, to Marquette among the wild Indians of the Illinois and Mississippi, to Huc among the Tartar tribes, to the Huguenot missionary on the banks of the Ogeechee, to the Quaker preacher in the sylvan lands of Penn.

But the hour warns me that I have too long taxed your

patience. On some future occasion it may be my privilege, gentlemen, to lay before you my plan of exploration more in detail. If it could so be brought about that the American Geographical Society should have the facilities placed at its disposal for taking in charge the final settlement of this great geographical question of the North, I as one of its members will be much rejoiced. It is here the interest properly centres. When the purposes of the Society become more widely known and more generally appreciated, as its facilities for obtaining and imparting information upon all questions relating to geography are fully understood by the citizens of New York, the road will be straight before us to what the Society may wish to do. Keeping on as it has done and is especially doing now, in these rooms which we owe to a citizen of rare public spirit (Mr. Peter Cooper), its wants and the public needs will be mutually recognized; and then, in this great mart of wealth and industry, the Society will be always able to command the means necessary to enterprises of the scope and character of that which I have named. Let us hope, at least, that they are not further beyond our reach than they are beyond our aspirations.

II.—*Communication from* Captain SILAS BENT *upon the routes to be pursued by expeditions to the North Pole.*

Communicated September 13, 1868.

2020 OLIVE STREET, ST. LOUIS, MO., *Sept.* 15, 1868.

Charles P. Daly, Esq., President of the American Geographical and Statistical Society:

SIR,—Having seen in the papers a short telegram that "England and Russia were about fitting out an expedition for the North Pole," and having given the subject some reflection in past years—or rather having had the practicability of such an object forced upon my mind by circumstances—I take the liberty of addressing you as the presiding officer of that Society in this country which will naturally take the deepest interest in the plans adopted by the expedition in regard to the route it is to pursue, to state that the result of these reflections is the creation of a strong doubt in my mind as to whether former expeditions to the Arctic Seas have not pursued a mistaken route in attempting to go by the way of Baffin's Bay, instead of by Behring's Straits, or Spitzbergen.

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And furthermore, that if Capt. McClure had stood boldly out to the northeast from Behring's Straits, instead of hugging the north shore of the Continent, he would most likely have carried an open sea and a warm current with him till reaching the north of Melville Island, and from thence had a southerly current to the Atlantic Ocean. In other words, whether the expeditions attempting the "Northwest passage" have not gone up stream against a hyperborean current, frigid in its temperature and filled with opposing ice, whilst if they had tried the *Northeast* passage they would have gone down stream, and carried with them the genial warmth of waters directly from the tropics, and I *think* an open pathway far into the Arctic Sea, if not to the very Pole itself.

To enable you to understand the process by which my mind was drawn gradually to this subject, and the conclusions which have been the result, it may not be amiss to enter somewhat into detail. These I shall endeavor to put in such a shape as to be readily followed, and as little tiresome as possible.

Before doing so, however, I will premise by saying, that the duties of a naval officer necessarily oblige him to be more or less observant of the currents of the ocean, as well as of the various other meteorological phenomena by which he is constantly surrounded. Yet it is not always the case that the phenomena presenting themselves within the scope of any one person's experience, lead to either complete results, or furnish even sufficient data upon which to base a reasonable hypothesis. Whether such has been the case in this instance I now with diffidence beg your judgment and indulgent patience to decide.

At the close of the Mexican war in 1848, the United States steamship Preble, to which I was attached as sailing-master (or navigator), was ordered from the coast of California on special service, under Commodore James Glynn, to China. In crossing the Pacific we stopped at the Sandwich Islands, where we found a large number of American whalers assembled for the winter. In conversation with one of the most intelligent of these captains, he told me he was just from a cruise in the Arctic Ocean, and that in pursuit of whales "he had gone several hundred miles to the northward and eastward from Behring's Straits, and *three hundred miles beyond the limit of his charts, and with an open sea still before him as far as could be seen in that direction.*"

From the Sandwich Islands we kept between the tropics, so as to avail ourselves of the Northeast Trade winds, and

a'so of the great Equatorial Current, which we found setting to the west at the rate of from thirty to eighty miles per day. This current, uniform and constant in its direction and velocity, and spreading from the Tropic of Cancer to Capricorn, has a width equal to that of the whole Atlantic Ocean. A few months after our arrival in China intelligence was received from the Governor-General of Java, that a number of shipwrecked American seamen were in prison at Nagasaki, in Japan, and the Preble was ordered to proceed thence at once, and endeavor to obtain their release. This was in midwinter, when the Northeast Monsoon was at its height, and when no vessels but steamers or opium clippers attempted to make passages to the north coast of China, and it was almost universally predicted by both Americans and English that our ship would never accomplish the voyage at that season of the year. But with true pluck the captain replied that "she should do it or else leave her bones in the bottom of the China Sea." I mention this to show how comparatively unknown were the dangers, and how unfrequented were the seas at that time, which lay in our way between Hong Hong and Nagasaki. As soon as we got out of port we encountered not only the full force of the monsoon, but also, in a manner, that of the southerly current, which constantly flows down the Formosa Channel, and with such strength that sailing vessels can never contend against it when—as at this season of the year—the wind blows in the same direction with the current, but are obliged to run out to the eastward of Formosa, where a current is always found setting to the northward, or in a diametrically opposite direction to that of the current first spoken of. The Preble struggled some ten or twelve days before reaching the south end of Formosa, although the distance is only about two hundred and fifty miles, having found the current down the Formosa Channel running to the southward at the rate of six miles per hour. She had hardly attained this point before the wind freshened into a stiff gale from northeast, compelling us to heave the ship to under storm sails, and preventing our getting any observations for latitude or longitude for three consecutive days. The effect of the wind upon a ship thus lying to—if uninfluenced by ocean currents—would be to drift her to leeward, or in the direction that the wind is blowing, at the rate of about thirty miles a day. At the expiration of the three days, therefore, when the storm abated and land was discovered to the westward, we thought it must be the Bashee Islands, which lie some hundred miles to the southward of

Formosa ; but upon standing in we found it to be the northern end of the latter island, and that we had been carried by a current ninety miles to the northward against the wind, or one hundred and eighty miles to the northward of where the ship would have been had there been no current, and near five hundred miles to the northward of where she would have been had she continued within the influence of the southerly current of the Formosa Channel! After determining our position upon the chart, we stood to the eastward for the Loo Choo Islands, running across and out of the northerly current. From Loo Choo our course was nearly due north to Nagasaki. In making this passage we found that we again crossed the current (but it there had a northeasterly direction), running out of its western limit of passing under the land of the Japanese Islands. After accomplishing the object of our mission to Nagasaki, we ran to the westward to Shanghae, and thence down the Formosa Channel to Hong Kong, carrying with us the strong southerly current before spoken of, although by this time the Northeast Monsoon had materially abated.

In the following summer the Preble was ordered back to California. The monsoons had then changed, and the wind was from the southwest ; yet we found the current still setting down the Formosa Channel, and on doubling the south end of the island we again fell at once into the stream setting to the northward, and which we found curved gradually to the eastward with us as we pursued our course on the arc of a great circle in that direction. This course, however, we were obliged to abandon about latitude 35° N., 145° E., owing to a malignant epidemic that had broken out in the ship, and which was aggravated by the fogs and mists that overhung the current.

The experience of this cruise thus confirmed the existence of two powerful currents which, in a general way, were well known to vessels trading or cruising in those seas, and which had been briefly noticed by writers upon the subject. But in what way, if at all, they formed a part of the great oceanic or inter-oceanic circulation was *not* known, and formed a bewildering subject to those who had to encounter them ; particularly as the charts were so inaccurate, that they were as likely to lead a vessel into danger as guard her from them ; and also as it was known that a few miles to the southward of the south end of Formosa, the great Equatorial Current poured its immense volume into the China Sea *almost directly at right angles to both of these currents.* This illustration

of their great velocity—their constant flow in fixed and opposite directions regardless of winds or seasons, and their juxtaposition—was well calculated to make a strong impression upon the mind, and set it to work to find out their origin, causes, and whither they led.

Sailing again for China and Japan in 1852, in Commodore Perry's Expedition, I had fortunately assigned to me for investigation during the cruise, such subjects of a scientific and professional character as enabled me to have instructions issued to the various vessels of the squadron, that insured a very thorough and careful meteorological record being kept during our operations in those seas; and after our return to the United States, I was detailed to assist Lieutenant M. F. Maury to prepare the charts, sailing directions, etc., for publication, and these meteorological records were placed in my hands for special examination in reference to the currents in that part of the Pacific Ocean and adjacent seas lying within the cruising grounds of the expedition.

The result of this investigation was the discovery of the fact that these currents formed a part of a great system in the Pacific, identical in all its essential features with that of the Atlantic, embracing the Equatorial Current, the Gulf Stream and its counter current along the eastern shores of the United States, as will be seen on referring to my report on the "Kuro-Siwo," or Japan Stream, published in the second volume of the Japan Expedition Report. The development of these facts, as the data were traced on the chart, created no small degree of surprise and gratification, and naturally led to further reflection and inquiry as to where these *counter* currents, to both the Gulf Stream and Kuro-Siwo, had their origin, and how far their compensating influence contributed to keep up the equilibrium of the waters of the two oceans.

In doing this, the first consideration was, that here were the two grand currents of the world; one in the Atlantic and the other in the Pacific, moving to the westward along the equator. That of the Atlantic finding no other outlet from the Gulf of Mexico, has its whole volume forced round to the north of Cuba, and deflected thence northwardly along the coast of Florida, forming the Gulf Stream—whilst that of the Pacific, passing mostly through the Polynesian Islands and China Sea, has a *large shaving*, as it were, torn off its northern side by the south end of Formosa, which by its condensed momentum is, like the Gulf Stream, thrown with increased velocity to the northward and forming the Kuro-Siwo or Japan Stream. These streams obeying certain physical

laws, bend gradually to the eastward as they advance on their northward course, until meeting with local obstructions the larger portion of each is turned to the southward—the one along the west coast of Europe, and the other along the west coast of America, ameliorating the climates of those sides of both the continents by their genial warmth, and finally falling again into the equatorial currents of their respective oceans. Portions of both of these streams, however, pursue their courses uninterruptedly to the northward and eastward into the Arctic Ocean—that from the Gulf Stream by the way of Spitzbergen, and that from the Kuro-Siwo by Behring's Straits. The accumulation of water about the Pole from these two offshoots must, of course, find an outlet somewhere, and it is in this that we find the origin of the counter currents of both the Gulf Stream and the Kuro-Siwo, as also that of the hyperborean current which flows to the southward along the east coast of Greenland, bearing within its embrace the largest of the icebergs seen by vessels plying between Europe and the United States, and far into the warm waters of the Gulf Stream, which it underruns as the latter crosses the Atlantic. The counter current of the Gulf Stream starting from the Arctic Ocean finds its outlet through the channels and passages leading into Baffin's Bay and Davis Straits, thence down the Labrador Coast to Newfoundland, and wedges itself in between the western side of the Gulf Stream and the shores of the United States. The counter current of the Kuro-Siwo finding but a narrow outlet at Behring's Straits, underruns the warm water flowing to the northward through these straits, and makes its appearance at the surface again on the coast of Kamschatka, and flows thence down through the Japan Sea, between the Japan Islands and the main coast of Asia, and through the Formosa Channel into the China Sea. An open sea along the Spitzbergen branch of the Gulf Stream has been explored far to the northward of the White Sea, but not to its uttermost limits, by either navigators or fishermen—whilst the current flowing to the northeast through Behring's Straits is known to our whalers, as shown by the statement of the captain of one of them, whom I have mentioned as having met at the Sandwich Islands, and which has been subsequently corroborated by the explorations of Captain John Rodgers, who in command of the United States North Pacific Exploring Expedition, penetrated to the northward of Behring's Straits in 1854 and '55, in search of Herald Island, reported by a British officer as lying to the northwest of those straits.

The island was not found, but an icy barrier was encountered in that direction (northwest), but as soon as he ran off to the northeast, he informed me he had *an open sea, with a current flowing to the northward and eastward, and with a temperature of the water much above that due to the latitude!* Now, when we examine the effects of these currents of water upon the climates of the regions of the earth over and near which they pass, it is very remarkable to what a degree they are modified and changed. For instance, the mild climate of Western Europe is owing entirely to the softening warmth carried thence from the tropics by the Gulf Stream, whilst the eastern coast of the United States owes much of its rigor to the hyperborean current which intervenes between it and the Gulf Stream; and we have Lisbon, in the latitude of Philadelphia, with the genial climate of Pensacola, and London, in latitude 52° north, with the climate of Norfolk; whilst the same phenomena of thermal difference is found equally marked between the two shores of the North Pacific, and attributable to precisely similar causes.

There is, however, a remarkably conservative feature in these currents, which owing to the non-conductive character of water and air, enables them to carry their warmth to such immense distances. So long as they are troughed or imbedded in the oceans, there is but little radiation of their heat; as will be seen by the thermometric scales on the diagrams accompanying the report on the Kuro-Siwo, where the changes of temperature of both the air and water is sudden and coincident with each other. And then, too, this is very noticeable on the east coasts of the United States and Asia, where the narrow, cold streams coming from the north, give climatic character to the land whose shores they wash; to the entire exclusion of any influence from the warm streams just outside of them. But as soon as these warm streams (the Gulf Stream and Kuro-Siwo) touch the opposite shores of their respective oceans, the land robs them of their heat, and so conducts and diffuses it far into the interior, that the temperature of nearly one-half of both continents is affected by it.

It does not seem, therefore, unreasonable to believe that the remaining portions of the Gulf Stream and Kuro-Siwo—possessing the same heat-conserving powers—that penetrate the Arctic Ocean, carry with them warmth enough not only to dissolve all the ice and snow they encounter in their paths, but enough also to keep an open sea about the Pole at all seasons of the year, and thus prevent this extremity of the

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earth becoming locked up in eternal ice, and overburdened in the lapse of ages with the accumulations of snow precipitated from the moisture of winds loaded with evaporations, and carried thence from more southern and warmer regions of the earth's surface. It was probably the southern edge of this open sea, with its temperature of +36° in latitude 81° north, that was seen by Dr. Kane's Expedition. The Doctor called at my office in New York, after his return in 1856, just as I had finished my work on the Kuro-Siwo; when I suggested to him that this open sea discovered by him, most likely owed its existence to the influences just named. He seemed impressed by the facts presented to him, and in his Narrative, vol. I., p. 309, when discussing the causes of this open water, he not only admits the possibility of such being the case, but evidently thinks it altogether likely.

I learn (from a newspaper telegram) that a private yacht sailed during the past summer for the North Pole, by the way of Spitzbergen. She is on the right track, and if she is a steamer and follows the water thermometer rather than the compass, I believe she will accomplish her object, and her return may be looked for any day this or next month.

In conclusion, I have merely to say, if my theory proves unworthy the consideration of your learned association, why then the matter most probably ends; but if it is correct, then I hope my humble suggestions may, in Heaven's Providence, be the means of averting the occurrence of some of the sad calamities that have attended former expeditions, and perhaps facilitate the solution of this great geographical problem that has so long occupied the attention of men of science.

With renewed assurances of the unaffected diffidence with which I have ventured to write you upon this subject,

I am, very respectfully,

Your ob't serv't,

SILAS BENT.

2020 OLIVE STREET, ST. LOUIS, *Oct.* 12, 1868.

CHARLES P. DALY, Esq., *President American Geographical and Statistical Society, New York:*

DEAR SIR,—Your kind favor of the 8th instant is received, and I pray you to accept my cordial acknowledgments for your courteous attention. I am much gratified to learn that my communication has been found by you worthy of being submitted to your Society. I shall watch with interest for accounts of the causes of failure in the recent attempt of the

yacht to reach the Pole by the way of Spitzbergen; though I expect to hear that—like Captain Parry and other explorers—she endeavored to steer *directly north*, after getting to the eastward of Spitzbergen, instead of keeping on to the northward and eastward along the path of the Gulf Stream until getting fully into the open sea.

This was the mistake made by Parry in 1827, who crossed the warm current of the Gulf Stream setting strongly to the northeast, before reaching Spitzbergen, and after getting to the northward of those islands he fought persistently against the southeastwardly set of the hyperborean current which he then fell in with, and which—if followed—would have carried him back into the Gulf Stream, and perhaps given him a much better chance of accomplishing his object with his ship, than he found in his sledge-boats. For on his return to the ship, after his failure with boats and sledges, he found to his surprise the sea all open to the northeast, and apparently affording, in his opinion—as expressed in his narrative—access for his ship to as high a latitude as he had reached in his laborious journey over the ice.

In my former communication, my hypothesis, that the Gulf Stream and Kuro-Siwo keep pathways open at all seasons to the Pole, should, perhaps, be qualified with an exception as to the early summer, when icebergs and field ice are both doubtless driven by the winds and counter currents well into—if not across—these streams, as they are into the Gulf Stream in the North Atlantic, and interrupting in this way a free passage for the time being; but which never form a permanent or solid ice barrier across these streams.

On that account, it may be, that the summer is not the best season for making the attempt to reach the open sea, but that the early spring, before the ice is detached from its winter fastenings, is the time best calculated for success. That there is an open sea, with a temperature permanently above the freezing point, surrounding the North Pole (and the South Pole too for that matter), I have no doubt. If this is the case, to reach the Pole then, it must be done in ships; *and the only avenues by which they can enter this Polar Sea is by following the Gulf Stream or Kuro-Siwo in their northeastwardly courses to that sea.* These afford the only accessible channels or gateways through the ice surrounding this sea; and to find and to follow these, the water thermometer is the only guide. Nor must the surface temperature be wholly relied upon, for Captain Rodgers—whom I have before spoken of—mentioned to me the remarkable fact, that northeast of Behr-

ing's Straits he found the water lying in layers of different temperatures. First a cool, then a warm, and beneath that a cold stratum of water! For a time I was at a loss to account for this, but upon subsequent reflection it occurred to me that this was a natural arrangement of waters of different specific gravities. That of the lowest temperature being the densest, clings to the bottom—the warmest water, from the salt it contains, being next in weight overlies the first, and then the cool fresh water formed by the dissolution of the ice, floats on the surface and is carried with, and becomes a part of the current immediately underlying it. This arrangement seems, too, to be a wise provision of Nature, by which the warm current is insulated, as it were, to prevent too great a loss of its temperature whilst passing the region of ice, but which, after reaching the open sea, and having by that time warmed the water above, it spreads out, whilst at rest for a time about the Pole, and throws off by the atmosphere much of its warmth before starting on its return course to the south again.

So it will be seen that a sub-surface temperature by the use of Six's thermometer, should be taken, as well as the surface temperature, whenever the latter is not above that of the atmosphere.

With renewed thanks for your goodness,

I am. very respectfully,

Your ob't serv't,

Silas Bent.

III.—*The Northmen in America.* By the Rev. B. F. De Costa.

Read December 17, 1868.

The first voyage to America of which we have any account was performed by the Northmen. But who were the Northmen?

The Northmen were the descendants of a race that in early times left Asia, travelled towards the north, and settled in the present territory of Denmark. From thence they overran Sweden and Norway, afterwards colonizing Iceland and Greenland. Their language was the old Danish (*Dönsk tunga*), once spoken all over the north, but now preserved in Iceland alone.

The first of these settlers reached Iceland in the year 875, when the Irish monks, who were there before, at once fled.

As it forms no part of my plan to trace the progress of colonization in Iceland, it will be sufficient to say that the new country continued to flourish, and in the course of time possessed a population of 60,000 souls.

At the close of the tenth century a westward movement was inaugurated by one Eric the Red, who had been banished the isle for manslaughter. At this time there was a rumor abroad that in the previous century, in the year 876, a man named Gunnbiorn, who was driven westward in a storm, had seen a new land, which was known by the people as "Gunnbiorn's Rocks." Accordingly Eric resolved to go in search of this land.

It is recorded that Eric sailed westward and found land, and afterwards returned. The next summer he sailed once more for Greenland, with a fleet of thirty-five ships, only fourteen of which reached their destination, the rest being either driven back or lost. This event took place fifteen winters before the introduction of Christianity into Iceland, which was accomplished in the year A. D. 1000. The date of Eric's second voyage must therefore be set down at 985. From this time the colonists rapidly increased in numbers.

The colonies were not established, as was formerly supposed, on the eastern coast of Greenland, but on the western coast, some distance northward of Cape Farewell. The expedition of Captain Graah, who was sent out to the east coast by the Danish Government, satisfactorily proved that no Icelandic settlements were ever established in the east. On the west coast are found the ruins of houses and churches. The walls of one church now standing are from four to five feet thick, which shows how solidly they built. Tombstones are also found inscribed with runic letters.

The colonies in Greenland continued to thrive until the beginning of the fifteenth century. A line of seventeen bishops expired with Andreas about the year 1409, nearly a century before the time of Columbus. In that year Bishop Andreas celebrated the marriage of a couple in the Cathedral Church at Garda, from whom the learned Professor Finn Magnussen derived his descent. This is the very last transaction in Greenland of which we have any account, until after the rediscovery of the western continent.

Thus we find that the Northmen occupied Greenland for a period of no less than three hundred years. It was during this period that they made their voyages to the coast of New England. But before proceeding to speak of the voyages it may be interesting to glance at what they accomplished in the north.

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At the last meeting of this Society we were favored with an able, exhaustive, and highly interesting lecture on Arctic Discovery in recent times, by one whose name will always be associated with the great efforts to reach the Polar Sea. Yet in this department the modern navigator has been somewhat anticipated by the men of the north.

Filled with their innate love of adventure, the Icelandic colonists in Greenland sought to increase their knowledge of that entire region, and to push their discoveries still further into the frozen region that surrounds the Pole. In the year 1824, when Parry was working his way towards the north, he found, to his great surprise, an inscribed monument on an island in lat. 73°. On his return a copy of the inscription was sent to Denmark, when it was found that the stone was placed in its position by three Icelandic explorers on the Saturday before Ascension Week in the year 1135. In the year 1266 a remarkable voyage was performed under the direction of the clergy, and a circumstantial account of it was transmitted by the Priest Haldor to Arnold, Chaplain to King Magnus of Norway. The voyage was made in a six-oared boat, and was attended by much hardship and suffering, although performed at the close of July. On the twenty-fifth of that month, noted as the festival of St. James, these explorers reached a point computed by Prof. Rafn to have been in the parallel of 75° 46′. Thus the bold Northmen, in a single boat, reached as high a latitude in 1266 as Parry attained in 1827.

But let us turn to consider their achievements in a more southern latitude on our own shores.

I need not delay here to show that they had ample means for the performance of the voyage. Their ships and their nautical knowledge were sufficient for the undertaking, while no one could question their daring enterprise. The Northmen were a people of no inferior attainments, but constituted the most enterprising portion of the race. They were fitted above all the men of their time for the work of exploration beyond the seas. They had made themselves known in every part of the civilized world by their daring as soldiers and navigators. Straying away into the distant east from whence they originally came, we see them laying the foundation of the Russian empire, swinging their battle-axes in the streets of Constantinople, carving their mystic runes upon the Lions of the Areopagus, and filling the heart of even the great Charlemagne with dismay. Says Dasent, when summing up their achievements: "In Byzantium they are the

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A MAP OF CAPE COD AS IT APPEARED AT THE BEGINNING OF THE 17TH CENTURY.

leaders of the Greek emperor's body guard, and the main support of his tottering throne. From France, led by Rollo, they tear away her fairest province and found a long line of kings. In Saxon England they are the bosom friends of such kings as Athelstane, and the sworn foes of Ethelred the Unready. In Danish England they are the foremost among the thanes of Canute, Swein, and Hardicanute, and keep down the native population with an iron heel."

This being so, is it unreasonable to suppose that they succeeded in reaching America?

Look for a moment at the map. When the Northman had reached Iceland he was far on his way to America. But a short voyage was required to reach its most northern part, which is Greenland. And from the southern coast of Greenland to Labrador is another short voyage, and from thence to the coast of New England the way is plain, and the ever-softening sky and air unite to allure the navigator on. Indeed, the only improbability exists in supposing that a people like the Northmen, who had left their footprints in every other part of the world, were capable of living for a period of three hundred years on the western coast of Greenland without raising a practical inquiry in regard to what countries lay beyond. To suppose that these men were thus idle and inefficient, is simply preposterous. Still the decision, in the absence of monuments like those of Greenland, turns upon a question of *fact*. The point is this: *Do the manuscripts which describe these voyages belong to the pre-Columbian age?* If so, then the Northmen are entitled to the credit of the prior discovery of America. That these manuscripts belong to the pre-Columbian age, is as capable of demonstration as the fact that the writings of Homer existed prior to the age of Christ.

The Flatö MSS., which contain the sagas relating to America, and now preserved in the Archives at Copenhagen, were finished in the present form in the year 1387, or 1395 at the latest, a whole century before the voyage of Columbus. The MSS. exist in their purity. They have not been tampered with or interpolated by post-Columbian writers. Now, a mineralogist who takes up a piece of quartz filled with particles of gold can tell in a moment whether that gold was originally infused into the rock by the process of nature, or was recently introduced by some scheming speculator. And I need hardly tell you that a literary expert can point out an interpolation in an old manuscript with equal facility. Yet the most careful scrutiny fails to detect interpolations.

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Nevertheless fault has been found with these writings, by a few persons who are determined to doubt in the face of all testimony. The objections brought against the substance of the narratives are extremely feeble; yet I may nevertheless glance at them.

As a specimen of the objections, I may allude first to the fact that the Sagas relating to America contain supernatural statements. It has also been charged that these writings are of a mythological character; yet as the latter charge is not based on any proper acquaintance with the Icelandic writings, I will pass it by. As is well known, the Northmen had an extensive and complete system of Mythology, yet it has not corrupted the histories under consideration, which form the earliest, purest, and the best prose to be found in the entire range of modern European literature.

Yet it is undeniable that there are supernatural statements. It is said that on one occasion a woman after her death rose up in her bed and spoke, and that another saw a spectre at her side. For such reasons some persons would dismiss the narratives as fabulous. But, on the same principle, how much recent history could we also dismiss to the realms of fable. Those who bring this objection forget that we have not yet altogether abandoned the idea of ghosts, while in the witchcraft prosecutions in Massachusetts grave judges condemned and ordered the execution of men on what was called "spectral testimony." The greatest New England divine of his day, the Rev. Cotton Mather, often adorned the historical sketches of that part of our country with tales of spectres and ghosts. Why, then, should we complain of an Icelandic writer who wrote several centuries earlier, when the world was vastly more superstitious than now, because he took occasion to make a passing reference of the kind?

Another objects that one narrative speaks of a "Uniped" seen in the distance on the shore. The word would indicate a human being with only one leg; but when Hendrick Hudson visited this coast six hundred years later, did he not see, among other wonders, a live *mermaid?* We all remember the description of one is given in his voyage. Columbus in his first voyage saw *three* mermaids; and also passed near an island inhabited, etc., not by Unipeds, but by "Amazons." So Josselyn, who visited New England in 1638, speaks of a "Triton," whatever that may be; and tells us that a fisherman chopped off the hands of one that tried to get into his boat.

There is another objection, that I would not allude to, but

for the fact that it has been urged by a distinguished writer, who says that the location of Vinland, the seat of the Icelandic settlements, has been sought for everywhere between Nova Scotia and Africa. The Icelandic records, however, give no support to his statement. On this point the Sagas say: "Beyond Greenland, southward, is Helluland (Labrador); beyond that is Markland (Nova Scotia); from thence it is *not far to* Vinland, which *some* men are of the opinion extends to Africa." The Saga writer, however, does not sanction the opinion, and the objection falls to the ground. Besides, if he *had* said that Vinland extended to Africa, it would not have made the location of the place uncertain. Every one acquainted with our early history knows that at one time Virginia extended over this whole country, while many supposed that this land extended to India. Yet when the navigator left England for Virginia he laid his course direct for the mouth of James river. The same was the case with the Northmen in sailing for Vinland. However far that country may have extended, they knew just where to look for the site of their colony.

But, finally, one has objected to the truth of the Icelandic Sagas for the reason that he thinks the productions of the country described do not answer to the inventory of the Northmen.

The particular thing objected to is a piece of rare wood for which it is difficult, with certainty, to assign a name or use. The piece of wood in question was carried from the shores of New England to Iceland, and from thence to Norway, where the possessor sold it for a handsome sum. It is called *macer* wood, and may have been a piece of very handsome maple. But the objector argues from the PRICE that it must have been a piece of wood that did not grow in New England, that it must have been Brazil-wood or rare mahogany. Therefore the alleged voyages of the Northmen did not take place. Such persons overlook the fact that explorers are liable to give too favorable views of the productions of a country they have discovered. Eric the Red gave Greenland the name it now bears simply to make a favorable impression of its qualities. Some of his stories were almost fabulous, yet who denies that he ever saw Greenland? In the early days of Puritan New England there was the same misrepresentation of Massachusetts Bay, and Governor Dudley was obliged to put in a protest against it. So, on the coast of Maine, George Popham wrote home to his patron from Sagadahoc, that among the productions found were "cinna-

mon and nutmegs." Now, on the principle of the objector, we ought to hold that Popham never saw the coast of Maine.

But the Icelandic writer was more judicious. He did not claim to find any cinnamon or nutmegs, nor even mahogany or Brazil-wood, but simply a piece of handsome wood that in Norway brought a high price. The objection, therefore, exists only in the minds of those who made it.

But let us now speak of the voyages themselves.

The first glimpse of America was obtained by one Biarne, who, in sailing for Greenland, in the year 986, was driven upon the American coast by a storm. The report of this voyage induced Leif, son of Eric the Red, to seek for the new land. In the year 1000 he sailed from Greenland, passed down the American coast, coasted around Cape Cod, and entered Mount Hope Bay in the State of Rhode Island, where he built huts or booths, and spent the winter. In the spring he returned to Greenland with a cargo of wood and furs.

In the year 1002 his brother Thorvald visited the same place, where he wintered, and the following spring sailed around Cape Cod to Massachusetts Bay. Off what is now called Race Point, they broke the keel of their vessel, and landed to make a new one. The old one was set up as a landmark, and the place was called Kiarlarness, or Cape of the Keel, which is indicated by the accompanying map. They next sailed across towards Plymouth. This region of country pleased them highly. From thence they appear to have coasted along the shore towards Boston. Near a place now called Point Alderton, they were attacked by the natives, when Thorvald was slain by an arrow. At his own request he was buried at a spot near Plymouth, and crosses were placed at the head and foot of his grave. The expedition then returned to Greenland. Thorstein, his brother, went afterwards to bring home his body, but failed to find the place, and returned to Greenland, where he died.

These, and all the subsequent voyages to America, it will be seen, were made from Greenland, and not from Iceland.

The most distinguished explorer was Thorfinn Karlsefne, who sailed with three vessels and one hundred and sixty men in the spring of 1007. They spent the greater portion of three years in that part of Rhode Island lying around Mount Hope Bay. Here his son Snorre was born. This child was afterwards educated in Iceland and became the first of the line of Bishops that have presided over the ecclesiastical affairs of that country. From him also was descended Thorwaldsen the sculptor, who placed in the Cathedral

Church of Reikiavik, in Iceland, a beautiful font in acknowledgment of his Icelandic descent. As I intend to allude again to the voyage of Karlsefne, I will only mention one very curious and valuable proof of the authenticity of his narrative. While his party were at Mount Hope Bay, which was also called "Hop" by the Northmen, they had a severe fight with the natives, who used a curious instrument of warfare. The writer says: "Karlsefne's people saw that they raised upon a pole a very large ball, something like a sheep's paunch, and of a blue color; this they swung from the pole over Karlsefne's men, upon the ground, and it made a great noise as it fell down. This caused great fear with Karlsefne's men." And, so far as my knowledge extends, the antiquarians have never given any explanation of this passage, which at first sounds childish. But by referring to Schoolcraft's work on the Indians (vol. i., p. 83), we find that such an instrument was actually employed in this country at a very early period. Schoolcraft says that many generations ago the natives used to sew up a round boulder in the skin of an animal, and hang it upon a pole which was borne by several warriors, and when brought down suddenly upon a group of men produced consternation and death. This mode of warfare has not been practised for the last three hundred years, but must have prevailed about the period that the Northmen were in America.

The last voyage of which we have an account took place in 1011, chiefly under the direction of a woman, a sister of Leif Ericson, named Freydis, who, with the assistance of her confederates, murdered a whole ship's crew in one of her quarrels. She passed but one winter in New England.

What are called the Minor Narratives refer to a voyage of Are Marson to a land southwest of Iceland, called Whiteman's Land, or Great Ireland. This was prior to Leif's voyage, taking place in the year 983. Biorn Asbrandson is supposed to have gone to the same place in the year 999.

But where was this Whiteman's Land, or Great Ireland? The saga which gives the account of Marson's voyage says that it lies "in the Western Ocean opposite Vinland, six days' sail west of Ireland." Prof. Rafn thought that this country was Florida, and that in course of time the numerals VI. had taken the place of the larger and correct number of days' sail, which would afford the navigator sufficient time to reach that part of the coast of America. But in this, perhaps, Prof. Rafn shows too much anxiety. The learned Finn Magnussen accepts VI. as the right number, while

Schöning points to the Azores as Great Ireland. To a place bearing this name the Icelander, Marson, undoubtedly went, though we cannot now fix its precise locality. Nor is this needed in order to assure us of the reality of the pre-Columbian discovery of America. The voyages to New England being established beyond all reasonable question, we can well afford to abstain from any false construction of the Minor Narratives, and, indeed, dispense with them altogether.

After the voyage of Freydis to New England in 1011 we have no other narratives, though there are *allusions* to voyages. We find that Bishop Eric, after his consecration as Bishop of Greenland, resigned that See, and, in the year 1121, sailed on a voyage to Vinland. So likewise we find that in 1285 New Land was rediscovered by the Northmen. It was called *Nyja-funda Land*—a name that may *possibly* have suggested the modern Newfoundland; while in 1357 a voyage was made to Markland, the present Nova Scotia, to cut timber. With these brief notices the narratives come to an end; and the Greenland Colonies having died out, the new land in the west ceased to be an object of interest with the people of the North, who gave the subject no attention until the world was aroused by the discoveries of Columbus. Then the old sagas were brought out from the Library of the Monastery in Flatö announcing the pre-Columbian discovery of America.

It may be asked, Why did the discoveries of the Northmen in the eleventh century create no sensation? The answer is very simple. The age was not ripe for discovery. The compass and the printing press were still unknown, the ocean was an object of dread, while the Northmen themselves had not the faintest conception of the value of their work. Adam of Bremen was one of the few persons in Europe who ever heard of the trans-Atlantic voyages, and he only mentions them incidentally.

The position of the Icelandic Colonies in America was at first supposed to have been in the region of Nova Scotia, but the more accurate calculations of Prof. Rafn and others have fixed the position in Rhode Island, in latitude 41° 24′ 10″. The scientific process by which this result was worked out need not here be detailed, especially as we are able to identify the localities from the descriptions of the sagas themselves. To this point let us now turn our attention for a few minutes.

The first land made by the Northmen after they left Greenland was Labrador. This they called *Helluland*, from

Hellu, a flat stone, many of which are found in that region, being of great size. After landing here, they sailed south again and found a flat country overgrown with wood. Then Leif said, "We shall give this land a name according to its kind;" accordingly he called it Markland, or Woodland. This, with all reason, is supposed to have been Nova Scotia. The description of the saga accords well with that of the coast pilot. Sailing thence for two days, with a northeast wind, they at last came in sight of an island that lay on the north side of the land. This land was Cape Cod. The voyage from Nova Scotia to Cape Cod is one which a good ship, under favorable circumstances, could easily accomplish within the specified time, though the time is not expressed in the saga with any scientific exactness. Leif evidently sailed these two days with at least a strong breeze, for the saga says that on reaching the land they disembarked upon an island to wait for good weather. This island has given the interpreters considerable trouble, from the fact that it is said to lie to the northward of the land. Prof. Rafn shows that the north point of the Icelandic compass lay towards the east, but this does not fairly meet the case. There would, perhaps, have been no difficulty in the interpretation, if he had been acquainted with the fact, that in early times an island existed on the opposite coast of Cape Cod. This island, together with a large point of land, has now disappeared. Its position, as well as with the point of land, is delineated in the map. At one time, some doubt existed in regard to the truthfulness of the accounts, for the reason that those portions of land described no longer existed, yet their positions were laid down with scientific accuracy by Gosnold; the outer portion of the island being called Point Care, and the other Point Gilbert. Neither Archer nor Brereton in their accounts of Gosnold's voyage, gives the name of the island: but Captain John Smith, in 1614, calls it "Isle Nawset." This island was of the drift formation, and as late as half a century ago, a portion of it still remained, being called Slut Bush. The subject has been very carefully gone into by Mr. Otis, in his pamphlet on the *Discovery of an Ancient Ship on Cape Cod.* Professor Agassiz, writing December 17, 1863, says: "Surprising and perhaps incredible as the statements of Mr. Amos Otis may *appear*, they are nevertheless the direct and natural inference of the observations which may be easily made along the eastern coast of Cape Cod. Having of late felt a special interest in the geological structure of that remarkable region,

I have repeatedly visited it during the past summer, and, in company with Mr. Otis, examined, on one occasion, with the most minute care, the evidence of the former existence of Isle Nawset and Point Gilbert. I found it as satisfactory as any geological evidence can be. Besides its scientific interest," he adds, "this result has some historical imporance. At all events it fully vindicates Archer's account of the aspect of Cape Cod, at the time of its discovery in 1602, and shows him to have been a truthful and accurate observer."

Now, in all this Prof. Agassiz had no idea of vindicating the Northmen. Still he has unwittingly left a testimony in their favor, by declaring the former existence of the island. Since the days of the Northmen great changes have taken place in this whole region, which affords the most interesting subject for geological discussion to be found on the Atlantic coast. Glance at the map drawn from the plans of the U. S. C. Survey, and you will see how extensively the work of denudation has gone on, the shores of Cape Cod and Nantucket having beautiful rounded lines formed by the action of the sea, which is now rapidly cutting away the whole region. The banks and shoals of Georges, lying to the eastward of the cape, are nothing but dead islands that once lifted their verdure-crowned heads above the waves. If Prof. Rafn had known of the existence of this great island, and the point called Point Gilbert, he would never have forced the language of the sagas so to make Nantucket the island referred to. What was called Webb's Island, which in 1790 lay nine miles out at sea, may have been a remnant of Point Gilbert. It is laid down in the map of Nicholas Sanson, in 1688.

In the account of Karlsefne's voyage there is another passage that is cleared up by Prof. Agassiz's demonstration of the existence of the island.

It is said that here they called the land *Wonder-strand*, because they were so long in going by, yet whoever sails along this shore now, will not be impressed by the length of the voyage. This is because the coast has completely changed, and the shore line has been reduced one-half or two-thirds by the destruction of the islands and projecting points. Leif also put into this place, and landed for safety in a northeast storm, which could not be done to-day; yet at that time the configuration of the coast was such as to afford numerous snug harbors. The writer of Karlsefne's voyage speaks of the long shores of sand at Kiarlarness, for which this region

is noted, and where, as he says, there were no harbors. Yet when he came to the island and passed into the bay between Isle Nawset and Point Gilbert, he found a harbor in which they anchored for three days. Likewise Archer, in his account of Gosnold's voyage, says, that when they rounded Point Care, the extremity of Isle Nawset, "We bore up again with the land, and in the night, came with it anchoring in eight fathoms." At this point, the narrative of Karlsefne says, "the land became indented with coves," and Gosnold's voyage curiously records the same feature. But now island and headland and coves have all gone down beneath the waves, and the whole coast presents a smooth, melancholy waste.

There are many minor points wherein the descriptions of the Northmen happily agree with this coast and its productions, yet there is not now time to dwell upon them. I may, however, allude to the fact that the expedition of Karlsefne passed around the cape from Rhode Island to the vicinity of Boston, where, you remember, the leader of one expedition was mortally wounded in a fight with the natives. And here they came to a conclusion which we now know to be a fact. From this point they saw what must have been the celebrated Blue Hill Range, and they inferred that it was the same range that they had seen near their settlement at Mount Hope Bay. The writer, in recording the voyage, says: "They looked upon the mountain range that was at Hop, and that which they now found, as all one." And by a reference to the map, we find that the Blue Hill Range actually extends across the country to the vicinity of Mount Hope Bay.

In Greenland the monumental remains of the Northmen are abundant, but it is to be questioned whether anything of the kind will ever be found in New England, the celebrated Dighton Rock, the Newport Mill, and the skeleton in armor found at Fall River, being now hardly considered as relics of the Northmen.

Besides, monumental evidence is not needed. The authenticity of the Icelandic records has been vindicated, and their historical character has been placed beyond reasonable question. We must also remember that the occupation of the country by the Northmen was only temporary. Thorfinn Karlsefne spent about three years in his visit, finally discovering that he could not maintain himself against the hostile tribes. Leif, in his voyage of the year 1000, erected several houses of wood, which, with a few additions, answered the

purpose of those who afterwards came; yet these and all similar memorials must have soon passed away. Besides, if they had built structures of stone as strong as the Pyramids, on Isle Nawset or Point Gilbert, or, indeed, anywhere on the littoral parts of the New England coast, they would long since have been buried in the sea.

And it is proper, before closing, to refer to the fact that there have been changes in the inhabitants as well as in the land. The people with whom Karlsefne fought had the habits but not the general appearance of the North American Indians, being short of stature like the Esquimaux. Nor can this circumstance detract from the value of the narratives. For everything goes to indicate that the present inhabitants of Greenland and vicinity once must have dwelt along the New England coast, and that they have gradually made their way towards the north with the walrus, the great auk, and the polar bear. The great auk has, as you are doubtless well aware, left the New England coast within modern times. Professor Wyman recently found some of the bones of this bird in the shell-heaps of Mount Desert, Me. The Esquimaux at an early date followed the retreat of the ice-period which prevailed on the coast to the north, and those met by the Icelanders in Massachusetts and Rhode Island were a portion of the tribe left behind. This is in accordance with the well-known fact that the North American Indians claimed no antiquity as possessors of the soil, and that the oldest distribution of the roving American tribes does not date back further than the tenth century, when the ancestors of the Aztecs went southward, and settled in Mexico.

But though the ancient people of New England have passed away, and large portions of land have gone down beneath the sea, the immortal histories of Iceland remain. These are daily becoming better understood, and with the study of the records invariably comes the conviction of their truth. As I reminded you at the outset, we are here called to credit no inferior people. The Northmen came of a noble stock. Some of us listened last evening* to a glowing tribute to their character, in which, however, they were alluded to as pirates. But the allusion was not unjust. Still we must remember that they were pirates in an age when might made right, and piracy was more or less respectable. And they often fought for the noblest prize, for

* The Lecture of the Hon. John Lothrop Motley, on the occasion of the anniversary of the New York Historical Society.

a kingdom and crown. They were magnificent pirates, for only such could have made the heart of Charlemagne quake with fear. But they always gave as much as they took; since it was the infusion of their blood, and the invigorating force of their brain, that made the feebler peoples whom they conquered capable of conquering others in turn. Besides, wherever they were victorious with the sword, they ruled with their speech. Their language was the language of the Court, not only in Denmark and Norway, but in England and France; and to-day, while the language of King Alfred and his contemporaries is known only to a few, and the splendid tongues of Greece and Rome are likewise dead, the language of the Northman is alive, and is spoken with all its old-time purity and power.

Again, let me say, if the Northmen were pirates, they were a people of progress, and the first to pronounce piracy a crime. Their vikings and rovers had all been called peacefully home at a time when the moral sense of the southern nations slumbered, and the freebooters of England were sailing on every sea. They were still further in advance on the subject of the duel. In England the duel was retained on the statute-book as a part of the judicial process, eight hundred and six years after the Northmen had solemnly abolished that cruel and barbarous custom by a positive law.

One other thing we must remember, namely, that piracy was confined to the Continent. In those early days ships sailed on peaceful trading voyages from Iceland to Shetland, to the Orkneys, to Dublin, to Limerick, to the ports of England and Scotland; and, returning, these white-winged messengers flew, as doves to their windows, for the Icelandic ports beyond the cold sea. But among them all there was no pirate. No freebooter's ship ever sailed out from an Icelandic harbor, to indulge in pillage on the main. That country was settled by the *élite* of Norway, by men who constituted its best element, and who were too proud to yield obedience to a tyrannical king. They were the Pilgrim Fathers of the North, who, above all things, desired to be free. And the freedom which they sought they gained. In their lonely isle they founded an aristocratic republic, raised up an imperishable literature, and compiled a wise and comprehensive body of law.

And as their statesmanship was wise, so was their poetical genius great. America, with all her marvellous industry, has

yet to furnish a poetical work that will compare with the Edda of Iceland, in bold, original, and lofty genius, and immortal thought; and when the best compositions of the writers of to-day have been forgotten, the collections of Sæmund the Wise will have an honored place by the side of Homer and Milton, and hold an equal rank with Shakespeare, Tasso, and Dante.

In historical composition, the Northman appears equally commanding. Sturleson, of the north, the author of "Heimskringler," is a fit companion for Herodotus, his brother of the south. In Iceland, history was cultivated with a zeal that has characterized no people or age before or since. We find that it even spread to Greenland itself, where it is recorded that in the winter before Karlsefne sailed on his three-years' expedition to New England, the people through the long evenings were accustomed to assemble around the driftwood fires, to listen to historical recitations. And it is these men, who set up the printing press a hundred years before the founding of Plymouth, men whose spirit and enterprise have never been surpassed,—that sailed from Greenland, explored the American coast, and inscribed the history of their achievements in the chronicles of the north. And if men like these are not to be credited when they declare that they discovered the American coast, it is time that we had discarded all chronicles and bidden ancient history a long farewell.

I have thus far said little of Columbus, for the reason that little needs to be said. The discovery of America by the Northmen detracts nothing from the merit of the work of Columbus. The patience and courage and perseverance, and, above all, the lofty faith of that great navigator, have made his name glorious for all time. His was an independent discovery; and since the justice due to the Northmen requires no depreciation of Columbus, so the justice due to *Columbus* demands no depreciation of the *Northmen*. Honor to the noble and the brave of every age and clime! For whoever, by fortitude, patience, and self-denial, increases our knowledge of Geography, contributes to one of the noblest of sciences, and adds to the dignity and happiness of mankind.

IV.—*On the Geology of Brazil.* By Ch. Fred. Hartt, A. M., Professor of Geology and Natural History in Vassar College, now Professor of Geology in Cornell University.

Read June 12, 1868.

In the year 1865 I had the honor of accompanying Professor Agassiz to Brazil, as one of the geologists of the Thayer Expedition, and during our fourteen months' stay in the country I was engaged in making a careful examination of the geology of the vicinity of Rio de Janeiro, and of the coast northward as far as Bahia, while at the same time, with the assistance of my companion, Mr. Copeland, I made extensive collections, illustrative, more particularly, of the land and fresh-water faunæ of the district explored. The greater part of my journey was performed quite leisurely on horseback or by canoe. I ascended all the principal rivers south of the Rio Pardo, as far as the foot of the Cordilheira, so that I had the opportunity of making lengthy geological sections. By way of the Mucury, I entered the Province of Minas Geraes, visited the gold region of Minas Novas, and then descended to the sea by the Rio Jequitinhonha, thereby gaining the key to the geology of the valley of that river. While travelling along the sea-shore I studied with care the solidified beaches, or *recifes*, and examined the coral reefs of Porto Seguro and Sta. Cruz. Recalled by Professor Agassiz at the termination of the labors of the Expedition, I visited Ilhéos and Camamú, on my way to Bahia, and, during a few days' stay at the latter city, made some interesting observations on the cretaceous deposits along the Bahia and São Francisco Railroad. It will be seen that, travelling in this way, I had an excellent opportunity of studying the geology of the country. I was not satisfied with the few observations which I had been able to make on the coral reefs, and, suspecting that they had a very large extension along the coast of the southern part of the Province of Bahia, I returned to Brazil the year after the return of the Expedition, visited the reefs of the Abrolhos and vicinity, and examined them at several points to the northward of Bahia. I was exceedingly fortunate in finding the means of travelling rapidly from point to point by steam, thanks to the kindness of Doctor Antonio de Lacerda, Mr. Wilson, and Mr. Mowry, of Bahia, and during my short stay I was enabled to study the geology of Bahia and vicinity; to visit several localities in the Provinces

of Sergipe and Alagôas, and ascend the Rio São Francisco, to within a few miles of the falls of Paulo Affonso. After these two journeys I had seen almost every foot of the coast between Rio and Pernambuco, so that it will be seen that the interpretation which I shall give of the geological structure of the coast, is not the result of a cursory examination of a few isolated points, but is deduced from and verified by the comparison of a large number of sections, worked out with more or less detail.

The Province of Rio de Janeiro, excepting a small tract along the shore north of Cape Frio, is mountainous and high. The rock is gneiss, similar in character to the eozoic gneisses of the eastern border of North America, and corresponding with them in the trend of its foldings, while it is overlaid by lower palæozoic rocks in such a way as to warrant one in referring them to the *eozoic*. These rocks are so folded and denuded as to form a series of mountain ranges, with a general north-easterly trend, occupying nearly the whole province; but breaking down abruptly near the coast north of Cape Frio, on the edge of the coast plains. From Cape Frio to the Province of São Paulo, and along that province, the coast lands are bold and hilly. Owing to the direction of the mountain ranges and the barrier formed along the southern coast by the Serra do Mar, the drainage is toward the east, and the principal river of the province, the Rio Parahyba do Sul, though rising near the sea, flows through the whole province parallel with the coast, and escapes into the ocean north of Cape Frio. On most maps of Brazil a serra or cordilheira is shown as running parallel to the sea-coast from Rio northward. There is in reality no such continuous cordilheira. The high lands seen in sailing along the coast are not a continuous mountain range, but the edge of a gneiss plateau, whose mountains form a system of short ridges, which, with a general uniform north-easterly trend, break down abruptly on reaching the edge of the plateau. The highest mountains of the Province of Rio de Janeiro are the Organs, which, according to Gardiner, are only about 8,000 feet in altitude; those along the coast to the northward are much less, though in the interior there are hills of considerable elevation, the Serra da Mantiqueira being, according to Gerber, 1288 metres in height.* The gneiss districts south of Bahia are, as a general thing, covered with a deep rich soil,

* The peak of Itacolumí is, according to Gerber, 1,750 metres in elevation.

and are clothed by a most luxuriant forest growth, which descends to and spreads over the fertile coast plains. This forest belt varies in width, depending on the character of the climate, the distribution of rain through the year, etc. It covers the whole of the Province of Rio, and extends broadly northward through the Province of Espirito Santo, where, on the Rio Doce, it is as luxuriant as on the Amazonas. In the eastern part of the Province of Minas Geraes, in the Mucury region, it is some 200 miles in width, but northward, as the climate changes, and there is little rain, or the rains fall only during certain seasons of the year, the forest belt becomes very narrow, and only fringes the coast.

The deep, red, clayey drift-soils of the gneiss lands are the best for coffee; and along the coast north of Rio the coffee plantations are principally confined to them. Owing to the want of roads, the poor navigability of the rivers, and a lack of energy in the people, the whole of this forest country is in a very backward state, and the greater part is a wilderness. Of the breadth of the coast gneiss belt to the southward I can give no estimate, owing to its never having been sufficiently explored; but in the Province of Minas Geraes, between Sta. Clara and Minas Novas, it is about seventy-five miles wide, more or less. From my own observations, as well as those of others, its inner boundary appears to run off southwestward to the vicinity of Diamantina. From that city there trends off northward, somewhat eastward, a belt of mountainous country, composed of altered palæozoic rocks, forming a series of serras, which go by many different names, but which, in the aggregate, are often known on maps as the Serra da Itacambira, and belong to the system of the Serra do Espinhaço. It is to this serra, and the streams flowing from it, that the principal diamond mines of Eastern Minas Geraes are confined.

Two considerable rivers, the Jequitinhonha and the Arassuahy, take their rise near Diamantina, and, flowing almost parallel northwards between this serra and the gneiss belt, unite their waters at about latitude 17°, and, thereafter known as the Jequitinhonha, flow on with a general northeast course to the sea. The Jequitinhonha, from its head waters almost to its confluence with the Arassuahy, is noted for its wealth in diamonds, and during certain seasons of the year thousands of persons are engaged in washing for them in the gravel and sand of the river bed. The Arassuahy is rich in gold from its head waters to the Arraial da Chapada, at least.

The basin between the two belts of high mountain lands diverging near Diamantina is mainly occupied by thick, horizontal beds of clays and clayey sandstones, Tertiary, which are in some places 2,000 feet in thickness, and the country is consequently flat, forming a series of immense, level, woodless plains. So soft are these deposits, that the streams have almost everywhere cut down through them to the harder and older rocks below, making deep, narrow valleys or cañons, with very steep sides. The waters of the Calháo, Setubal, etc., flowing close together into the Arassuahy, have united their valleys in their lower courses, making a wide valley with a rolling bottom, sunk many hundreds of feet below the general level of the surrounding plains, and resembling a dried-up lake.

On leaving the plains and descending into the valley of the Arassuahy, near Calháo, I was exceedingly struck by the great resemblance borne by the rocks of the bottom of the valley to the auriferous slates of Nova Scotia; and although gold had never been found in them, I felt sure that the gold of Minas Novas must be derived from the same series; and, to settle the question, I made a journey thither. Everywhere between Calháo and Minas Novas, where the Tertiary rocks had been swept off, I found clay slates and quartzites, traversed by numerous quartz veins, the rock being to my eye scarcely distinguishable in general character from the auriferous clay slates and associated quartzites of many parts of the gold region of Nova Scotia. These rocks are highly inclined; their general strike is north-easterly, and the country they compose is moderately uneven, with low, rounded hills, covered by a sheet of rounded, often angular, milky quartz pebbles, over which is usually spread a more or less thick, concentric layer of red drift paste; but in many places this has been washed away, leaving the surface very stony and gravelly, and consequently barren. At Sucuriú, a little village situated on a stream of the same name, gold has been found in the *cascalho*, or gravel, not only of the streams, but of the drift of the hills. That of the streams has been washed to some little extent; but, owing to the want of water on the high grounds, the latter had scarcely been touched. After rains, nuggets are occasionally picked up over this tract, and these may be frequently seen in the hands of the inhabitants. Children wash the earth on the hillsides, and even in the gullies cut by the rains in the streets, and collect flakes of gold.

Between Sucuriú and Minas Novas there are strips of

Tertiary beds, forming narrow, elevated plains or *chapadas;* but the city of Minas Novas is situated in a sort of amphitheatre, made by the sweeping away, from over a large tract, of these newer deposits. This denuded region is very hilly, and, like Sucuriú, composed of slates and quartzites, with many veins of milky quartz, and the same overlying sheet of drift.

In 1727, one Sebastião Leme do Prado, with a considerable band of followers, came northward from the province of São Paulo, and explored the gold mines of Minas Geraes. They prospected in a little river, one of the eastern confluents of the Arassuahy, and finding little gold, called it the Fanado; but in one of its little branches they were more successful, and this they named the Bom Successo, which name it still bears. In the angle formed by the junction of these two rivers they founded the city of Minas Novas, and for many years mining was carried on in the vicinity, the gold being washed from the sand and gravel of the river, and from the drift, by stripping off the clay and washing the layer of pebbles and boulders that lay beneath the clay and immediately over the surface of the slates. In this work they met with great difficulty, owing to the want of water on the tops of the hills with which to wash the gravel. Trenches were dug around the hillsides to collect rain water, and tanks were built; but such a supply was very insufficient, and the work could, of course, be carried on only during the wet season. Yet large quantities of gold were extracted; and it is a matter of history that, during a few years, there were sent to Bahia many tons of the precious metal.

In the year 1746, on the discovery of diamonds at Diamantina, the mining of gold was prohibited, which put an end to the working of the gold mines of Minas Novas. In 1805 this prohibition was removed, but the blow was fatal. The diamond and gold washings of the Rios Arassuahy and Jequitinhonha have of late attracted all the attention, and the people have given up the more difficult gold-mining of the vicinity of Minas Novas for the easier and more profitable labor of diamond-washing; so that now little or no gold-mining from the drift is carried on. Minas Novas is falling to ruins, just as are the other surrounding towns, once important for their mines. I visited several mines in the immediate vicinity of Minas Novas—some, indeed, quite within its borders. I found that over small tracts the miner had removed the drift clay, and had washed the drift gravel by rain water, the white quartz pebbles and

boulders being left in the cuttings, which were generally quite shallow, sometimes fifteen to twenty feet deep, but usually very much less. There are a number of these small workings here, and the invariable report is that they were formerly very rich, but that they were abandoned because of the difficulty of obtaining water, and I see no reason to dispute it. I saw in the hands of Senhor Tristão Ottoni, the delegado, or principal police official of the city, fine specimens of gold in scales, which had been washed from the sands of the river near by; and I saw, also, some beautiful nuggets, weighing several ounces each, in the hands of persons who had obtained them from the drift of the vicinity. Some of these nuggets were very much battered, just as one might expect to see in drift specimens; others were crystalline and stringy, having been broken out of quartz pebbles. Nuggets are often picked up on the hillsides in the vicinity, principally after rains. The idea that these mines were abandoned because they were worked out, is most erroneous.

The slates are everywhere very much decomposed, being often turned into a soft, red earth—this, however, remaining *in situ*, and showing stratification; this decomposition extends sometimes to a depth of 60 to 100 feet. The action of the heavy rains flowing over the surface of the steep hillsides has excavated deep gullies, and the hills in some parts, as at the Arraial da Chapada, appear as if scored by a giant plough. These natural cuttings afford excellent sections.

There are several of these gullies in the neighborhood of Minas Novas. In exploring them, I found the footsteps of persons who regularly, after every rain, examine them for gold recently washed out. In the town, as well as elsewhere near by, I saw the little dams built across the rain-courses in the roads and streets by the children, who collect water in them with which to wash the earth for fine gold, which they collect in quills. Occasionally one finds a more extensive structure built for the same purpose by some of the elder inhabitants. The *cascalho*, or drift gravel, is made up entirely of pebbles of white, milky quartz, sometimes ferruginous—the pebbles being, as a general thing, rounded. Among them are great masses of quartz, also rounded, weighing several tons; and all are thrown together, without the slightest appearance of order, in a tolerably regular sheet spread over the surface of the decomposed rock, as above described. In some places this sheet is wanting, or very thin. I have seen it—as, for instance, at an opening in the upper part of

the town of Minas Novas—five to six or more feet in thickness. Its materials are often so cemented together by oxide of iron as to require to be broken up before washing.

I found many veins of quartz running through the decomposed rock exposed in the gullies; but in the very short examination I could make of them, I could detect no gold. In one of these excavations there are several beautiful corrugated quartz veins, which, cut across transversely, seem like single rows of logs piled one on the other in a steep fissure in the rock, their ends projecting—a feature which recalled once more the gold region of Nova Scotia.

From Minas Novas I went to the Arraial da Chapada, another old mining town, to-day fallen to decay and of no importance. It lies a few leagues northward of Minas Novas. The country between these two towns is hilly, composed of slate, and auriferous. The drift paste is often very thin, and great tracts of country are as hoary with quartz boulders and pebbles as are any of our drift regions in the north. Occasional old diggings were passed, but all were in situations where water was only to be collected from rain.

Some distance before reaching the village of Chapada I saw a *rega*, or old ditch, which winds in and out along the sides of the hills, and which was used to carry water to the washings of that locality. In the vicinity of the arraial were the richest as well as most extensively worked of the mines of the region, and the tops of whole hills have been worked over, leaving them covered with the heaps of washed boulders and pebbles. The method of mining was the same here as at Minas Novas. Masses of many pounds weight have been frequently taken out of these washings, and one nugget weighed 28 lbs. I heard this not only on the spot, but from the lips of Senator Ottoni, at Rio, and I have seen it also chronicled in Brazilian historical records.

The same influences that put an end to gold-mining at Minas Novas operated also here, and the washings are now entirely abandoned, and almost forgotten, in the excitement of the diamond washings of the Jequitinhonha, near by, where the difficulties to be overcome are not so great, and the prizes are of greater value. I saw here a few small washings recently made in the outskirts of the town, and was told that they paid well. I saw in the hands of parties at the Chapada, many beautiful nuggets accidentally picked up in the vicinity, some of these weighing several ounces. I here heard for the first time the terms *vein* and *gravel* gold, and was told that there were here veins of quartz from which

there had been taken lumps of gold, but that they had never been worked because no one knew how. Everyone told me of a vein of that kind which runs across the public square, and of a man who, discovering it in his cellar, dug so far in its pursuit as to undermine his neighbor's house, when he was found out. Here also may be seen the mud dams of the children who wash the earth of the streets, and collect quills full of gold. After rains parties search for gold in the gullies and water-courses.

That gold still exists abundantly over a large tract of country between Sucuriú, Minas Novas, and Chapada, there can be no doubt. In some places it has been worked under great disadvantages, and has paid well. Generally the old washings were on the sides of hills or on their tops, away from the water, and, though rivers or large brooks flowed just beneath, the idea of sending the gravel down to be washed at the water's edge, seems (so I was informed) never to have entered the minds of the Brazilian miners. The difficulty of obtaining water could, so far as the most of the washings are concerned, be easily overcome by the American engineer. The streams are rocky and rapid, and hydraulic power could, over large tracts, be commanded to almost any extent. I have no doubt that in very many places the drift could be washed by hose-pipes, after the Californian fashion.

It will be remembered that Minas Novas and the other auriferous localities are in places where the Tertiary clays have been stripped off from the auriferous slates. It would be a strange thing if the slates should prove auriferous only in these regions. Now that we know that gold may occur in rocks of any age, why may we not find it in the bottom beds of the Tertiary clays, or why may not auriferous beds be found under them? As to the age of the auriferous slates of Minas Novas, I feel convinced that they will be found to correspond to the lower silurian gold-bearing rocks of the eastern border region of North America.

I have seen no rocks in Brazil referable to the Devonian, unless it be that certain metamorphosed shales and a slate conglomerate, largely developed on the Rio Pardo, and containing stems of equisetaceous plants, may belong to that age; but they may be carboniferous.

The carboniferous rocks of Brazil are, on the coast, confined to the southern provinces of Sta. Catharina and Rio Grande do Sul, where a large area is occupied by them, and thick beds of bituminous coal of fine quality occur. These carboniferous beds have been studied by an English

geologist, Mr. Nathaniel Plant, who is laboring to develop their riches, and bring the coal into the Brazilian market, which is at present supplied from foreign sources. Mr. Plant had in his possession at Rio, a considerable collection of fossil plants from these rocks, and I had an opportunity of examining them. They were all of common carboniferous genera, and remarkably like the coal plants of our northern coal measures. Professor Agassiz also examined them, and felt no doubt that they indicated a true carboniferous flora. Carboniferous rocks have been reported from the western part of the Province of Matto Grosso, on the Guaporé. It would seem that either the coast north of the Province of Rio stood at a higher level during the carboniferous than it did in the south at that time, or that the upheaval which has brought up the carboniferous of the south did not extend to the coast to the north; for north of the province of Rio de Janeiro we have no evidence of the existence of carboniferous beds.

I have seen no triassic rocks on the Brazilian coast south of Bahia, but at Estancia, in the Province of Sergipe, I found heavy beds of red sandstone, precisely like the new-red-sandstones of the Connecticut valley, and of New Jersey. They underlie the cretaceous strata of the vicinity, and I have referred them to the triassic. These rocks have been slightly disturbed by an upheaval which took place probably at the close of the cretaceous. I have seen no sign of jurassic rocks on the Brazilian coast, but cretaceous deposits occur in various localities. At Bahia there is a series of sandstones, shales, and conglomerates, which have evidently been thrown down, in part at least, in a fresh-water basin, and contain very abundant remains of teleostian fishes, crocodilians, and dinosaurians, together with fresh-water shells and entomostracans.

At Maroïm, in the Province of Sergipe, the cretaceous rocks consist of compact limestones, with ammonites of several species, gasteropods, echinoids, etc., together with shaly and flaggy earthy limestones, with inocerami, fish remains, etc., and holding nodules of flint. On the Rio São Francisco, below Propriá, the cretaceous rocks are sandstones, grits, and shales, with little limestone. In the Province of Piauhy there are limestones, which afford the strange mailed fish, called by Professor Agassiz *aspidorhynchus*. Wherever I have seen the strata of the cretaceous on the Brazilian coast, they have invariably been upheaved and disturbed, which is a fact of interest, since the cretaceous rocks of the eastern border of

North America are quite undisturbed. Another interesting fact connected with the cretaceous is that, during that period there were volcanic disturbances along the eastern border of the continent, attended with the ejection of molten matter from beneath.

The great river valleys of the coast, as those of the São Francisco, Jequitinhonha, and that of Campinas in the Province of São Paulo, are largely filled up by very thick deposits of more or less sandy clays and soft sandstones, even one or two thousand feet in thickness, which are entirely undisturbed, and form immense plains, sometimes destitute of forest growth, as in the Province of Minas Geraes—sometimes richly wooded, as in the Province of São Paulo, according to the climate. These deposits are usually cut through, as above described in speaking of the valley of the Jequitinhonha or Arassuahy, by deep, narrow, steep-sided valleys or cañons, which are rarely ever precipitous. The whole seems to have been a deposit rapidly thrown down in a muddy sea, in which the conditions for animal life were unfavorable, for nowhere have I been able to find in these beds any fossil remains. The plains formed by this formation are sometimes elevated as much as 3,000 feet above the sea, as is the case in the interior of the Province of Bahia. In descending the Jequitinhonha, or São Francisco, one leaves these beds and plains, which end abruptly, crosses the gneiss belt of the coast, and finds a similar series of beds, consisting of variegated felspathic clays and coarse dark red and gritty sandstone, the latter lying beneath the clays, and only slightly elevated above the level of the sea. These coast beds I have first seen on the border of the Bay of Rio, but north of Cape Frio they begin again, and stretch northward with a varying width, between the Cordilheira or gneiss belt, and the sea, to Cape St. Roque, whence they extend along the coast to the Amazonas, tying-in with the clays and sandstones of Pará. They form a series of sertões or plains, cut across by narrow valleys. These plains are not perfectly level, but there is a gentle ascent from the coast—where the thickness above the sea level of the beds may be from 40 to 200 feet—to the base of the Cordilheira, where it may be 500 feet or more. The coast beds nowhere tie-in with those of the higher grounds, and they are evidently newer in age. I have referred them both to the Tertiary,* because they overlie

* Since the above paper was prepared Prof. Agassiz, in conversation with the writer, expressed the opinion that these coast clays were drift.

unconformably the cretaceous beds, and because they are glaciated, and overlaid by the sheet of drift clay and gravel.

The whole country, from a height of a few feet above the present sea level to the greatest height I have examined, some 4,000 feet, is everywhere covered by loose materials, which, in different parts of the country, have different characters. At Rio, and along the coast range, the surface of the rock is *moutonnée*, and presents exactly the general moulding of a glaciated surface. It is true that the extraordinary decomposition which has prevailed over a large part of Brazil has had a large part to play in the shaping of the surface of the country; but a sharp eye can detect a different set of curves in the drift-covered surface from those which have resulted from the action of decomposition alone. The material which lies on the surface varies from a soft, red, sandy clay, more or less intermingled with pebbles and boulders, which are rounded or angular, to a sheet of boulders often of large size, with little admixture of clay; the amount of clay appearing to depend on the amount of decomposition which had obtained over the country at a time anterior to the drift. Thus, in the gneiss region along the coast, where the rains fall heavily, and the decomposition had softened the rock to a greater or less depth, this soft material was ground up and worked over. In this region we should expect to find few boulders except those of quartz. At Rio, Bahia, and everywhere else where it occurs, the clay is wholly without structure, showing not the slightest stratification, and offering no evidence of origin by water action. It is precisely such a material as would be formed by the mechanical grinding up of decomposed gneiss. I have examined in detail these surface deposits for many hundreds of miles along the coast, and feel perfectly satisfied that they are true drift.* In the clays, even in those regions where the decomposition of the rock most obtains, boulders of gneiss, trap, and other rocks are found, some of which do not belong to the immediate vicinity, and drift from the Cordilheira is found lying on the Tertiary plains of the coast. This clay sheet lies on all the slopes on which such materials can rest, and descends to within a few feet of the sea. It varies much in thickness, in some places being a hundred feet or more thick. Moraines occur in some localities within the region

* In a volume in course of preparation, "On the Geology and Physical Geography of the Coast Provinces of Brazil," I shall discuss in detail the whole subject of the Brazilian drift.

of decomposition, and fine examples are to be seen in the valley of Tijuca, at Rio, first examined by Prof. Agassiz, and afterward by myself. In this locality we find immense boulders of gneiss and greenstone thrown into a confused mass in the lower part of the valley, and presenting so clearly the appearance of drift that no one could possibly deny the agency of glaciers in their transport. But one must be exceedingly careful in his geological investigations in Brazil not to make blunders, for every loose block of stone that he sees lying on the surface is not necessarily a drift boulder; for, by the very decomposition which projecting rock masses undergo, there is a tendency for them to break up into rounded masses, which resemble boulders. Fine examples of these masses are to be seen on the shores of the Bay of Rio, in the little islands in the middle of the bay, and on the shores of the Bay of Victoria, in the Province of Espirito Santo, where the gneiss is very homogeneous and compact in its structure, and decomposes in concentric layers, that break up into boulder-like masses, which are well calculated to deceive a hasty and inexperienced observer. Trap dykes also sometimes furnish *boulders of decomposition*.

Through the interior of the Province of Bahia and Sergipe there extends, parallel to the coast, a zone of dry country, with scanty vegetation, where the drift phenomena are finely exhibited. The country forms, over large areas, an elevated, almost absolute, plain. The rocks of which it is composed are gneiss, the strata of which stand at a very high angle; but they are all reduced to very nearly the same level, and the general surface is marked by very shallow depressions, *without outlets*, which form ponds in the rainy season and are dry the remainder of the year; while the whole surface is strewn with blocks of gneiss and other rocks, some rounded, others angular, which present every appearance of true drift. The decomposition of those parts of this plain which I have examined was very slight, but I could find no glacial scratches.* If there is any part of Brazil where glacial scratches are likely to be found, it is here. I crossed this country on the dividing line between the Provinces of Sergipe and Alagôas, on the Rio São Francisco, and my observations have been confirmed by the reports of the Rev. Mr. Nicolaï and of Mr. Allen, the latter of Prof. Agassiz's party, both of whom made journeys across the middle of the Province of Bahia.

* In no locality that I examined was the rock surface sufficiently well preserved to have shown glacial striæ.

Mr. Allen reports a fact of much significance. He describes large pot-holes in the gneiss of the plains, far away from any obstacles over which water could fall; and there is no other possible way by which they could have been formed except by a glacial waterfall, which we know makes pot-holes in the rocks, glacial pot-holes of this description occurring on the tops of ridges in our own country.

Prof. Agassiz believes that the whole continent has been subjected to glacial action, and that the valley of the Amazonas was once occupied by an immense glacier. In his "Journey in Brazil," he speaks of the existence of moraines under the very equator.

In the shallow *lagôas* of Sergipe and Alagôas, and in the caverns of Minas Geraes, the remains of the mastodon, megatherium, glyptodon, etc., occur, the last two animals being interesting, because they show that South America, the land of edentates, was inhabited during the post-tertiary by giant representatives of that order.

Since the drift there has been a rise of the land along the Brazilian coast, amounting to a few feet. We find the drift everywhere, in localities unexposed to the sea, reaching down to the ancient sea-level; but in one locality, at Bahia, on the sea-shore, sands have been blown up over the drift sheet and have been in part solidified so as to protect it. A part of these sands have been removed by the sea in such a way as to show the drift extending to low-water mark, which would show that the coast stood at a higher elevation during the glacial period than at present; that it sank to the old water-level, and since then has risen to its present elevation. The stratified sands, containing recent shells, found raised above the present sea-level, would be a sufficient testimony of a recent uprise of the coast, but I have found additional evidence confirming this in the holes excavated by the sea-urchins in the rock on the sea-shore, now above the sea-level, as well as that offered by lines worn by waves at the bases of cliffs at Victoria.

The solidified beaches, or stone reefs, as for instance those of Pernambuco, Porto Seguro, and Sta. Cruz, and the coral reefs, are of recent formation. The Pernambucan reef is a long, narrow wall of sandstone, running like a break-water parallel with the shore, and a few hundred yards from it. It has been variously described as a coral reef, an upheaved ridge of cretaceous strata, etc. It is nothing more than a beach, which has been solidified in the lower part by the cementing of its sands by the lime of shells, corals, etc., em-

bedded in them. This beach has had its upper part swept away, and has been isolated from the shore by the washing away of the sands of the low grounds behind it. The rock of the reef is extremely hard; it still shows its beach structure, and is full of recent shells, such as are common on the neighboring beaches. The whole process of the growth of these reefs may be easily studied along the coast, between the Rios São Matheos and Doce. The stone reefs may be double or triple, as is the case at Porto Seguro and Sta. Cruz.

The coral reefs on the coast of Brazil begin in the Abrolhos region, in about latitude 18° S., where they are very largely developed, and, forming isolated patches, they extend northward beyond Cape São Roque. They present some remarkable points of structure. Over large areas the corals form tower-like masses called *chapeirões*, which sometimes are only a few feet in diameter, and are from 40 to 50 feet or more in height. These *chapeirões* usually grow close together, and ofttimes coalesce together to form reefs of several square miles in area. The species of corals which form the reefs are most of them distinct from those of the West Indies, and form a polyp fauna peculiar to the Brazilian coast. The genera which contribute most to the reefs are *acanthastræa*, *favia*, *heliastræa*, *siderastræa*, *millepora*, etc. The species of corals from these reefs, many of which are new, were described by Professor Verrill, of Yale, in the "Transactions of the Connecticut Academy of Arts and Sciences," (Vol. I., Feb., 1868, p. 351), and I have described the reefs in two little papers in the "American Naturalist," Vol. II.

The grand points in the geology of the coast of Brazil, which appear to us to be thus far established, are the following:

I.—It was by the rise of the *eozoic* lands of the Brazilian plateau that the first dry land was formed.

II.—The disturbance and metamorphosis of the auriferous (lower silurian) rocks was anterior to the carboniferous.

III.—During the carboniferous the coast stood higher than at present in the north, while a submergence took place in the south in the Province of Sta. Catharina, to allow of the accumulation of carboniferous strata. It is interesting to note that the peat swamps of the carboniferous of South America were south of the tropics. But peat bogs occur within

the tropics at the present day, and even in the vicinity of Bahia.

IV.—During the triassic the land between Sta. Catharina and Cape São Roque seems to have been more elevated in the south than at present, and to have been depressed in the north; and during this period, in certain localities at least, conditions obtained similar to those of triassic times on the eastern border region in North America, and beds of red sandstone were deposited.

V.—During the jurassic the coast evidently stood at a higher level than at present, at least south of Pernambuco, for no traces of jurassic rocks are to be found south of that point. This is interesting, because it shows a coincidence in the great movements between the coasts of North and South America.

VI.—During the cretaceous there was a sinking of the coast to the northward of the Jequitinhonha, a subsidence which extended over the whole Amazonian region, but which was not sufficient to cause the sea to enter the valley of the São Francisco, above the Falls of Paulo Affonso. Marine limestones and other strata formed outside the coast, while freshwater deposits accumulated in certain closed basins. The cretaceous rocks of Bahia and Sergipe probably belong to different horizons. The period was characterized by more or less volcanic disturbance.

VII.—The cretaceous rocks were upheaved and much denuded, and, probably during the later part of the Tertiary, along the coast, were sunk very uniformly, the whole plateau probably participating in the submergence; and in the north of Minas Geraes and in São Paulo, the sea rose to a height of some 3,000 or more feet above its present level. The loose material, long accumulated by the subaerial decomposition of the gneiss and other rocks, was worked over and laid down in the strata now occupying the upper parts of the great river valleys. After this the whole country rose very uniformly over the whole coast, until, through the Provinces of Rio, Espirito Santo, and Bahia, the sea bathed the slope of the cordilheira, a few hundred feet only above its present level, when beds of coarse red sandstone were thrown down over the submerged border of the continent, and over these were deposited thick beds of variegated felspathic clays,

similar to those of the higher river valleys of the interior; and these later beds extended along the coast northward, to and over the Amazonian region. The uniformity in character of these beds, over so immense an area, is something very remarkable. South of Rio I have not examined them; but they occur south of Brazil, on the plains of the Argentine Republic.

VIII.—At the time when the drift sheet was deposited, the land certainly stood at a much greater elevation than at present; for, in the vicinity of the Cantogallo Railroad, I have seen the drift extending down to sea level; and the same is true at Bahia. Drift clays and boulders are found over the whole coast so far north as Pernambuco, according to my own observations; but Prof. Agassiz describes the drift as occupying the whole valley of the Amazonas.

IX.—After the drift, there occurred a depression of the coast to a level, at Victoria, of about eight feet below our present sea-level. The land remained at this level for a short period; and then began to rise, laying bare and raising beaches and shore deposits, and adding to the coast considerable areas of swampy and low land, especially at the mouths of rivers; the beach ridges which form the present sea line were thrown up, and the stone and coral reefs were accumulated. The recent upheaval of the land I believe to be still in progress, my belief being based upon the shading off, in point of preservation, of the untenanted nests of the sea-urchins, in going upward from the zone of living sea-urchins on the rocky shores. The decomposition of the gneiss and other rocks of the coast has taken place since the drift.

V.—*Polar Magnetism. Its Astronomical Origin; its Period of Revolution and the Synodical Period of our Earth Identical.* By JOHN A. PARKER.

Delivered March 18, 1869.

IN a paper published by me, as read before the Society of the American Institute in March last, on the subject of Polar Magnetism, I showed, from the records of the variations of the compass for nearly three hundred years past, that the Magnetic Pole, in its movement westward, had in that period

passed over more than one hundred and sixty degrees of longitude in its revolution round the North Pole, or Geographical Pole of the Earth.

The reasoning on this subject appearing to be conclusive that the Magnetic Pole revolves about the North Pole, we were naturally led to the inquiry, what is Polar Magnetism? and what is the cause of this revolution? Those who have read my published paper on this subject with care will know that our solution of those questions was in effect: that the forces of magnetism and gravitation are identical; that the force which directs the needle to the Pole is wholly astronomical; that the source of the governing attraction is from the highest centre to which the Earth in her various revolutions is immediately related; that the revolution of the Earth relatively to that centre is the cause of the apparent revolution of the Magnetic Pole; that the period of the revolution, as indicated by the recorded variations of the compass, is about six hundred and forty years, more or less, to be determined; that the Earth in that period, as a satellite of the Sun, performs a revolution round the Sun relatively to the central point of the Sun's orbit, exactly similar to that which our own satellite, the Moon, performs in her synodical period, in which she revolves about the Earth, relatively to any given meridian, from opposite the Sun's centre (the central point of the Earth's orbit) to opposite that centre again.

These are our main positions, which we are bound to prove by direct and unequivocal evidence, and also to defend and sustain against all contrary evidence which the ingenuity and skill of scientific men may bring against it.

If these things shall prove to be true, a reviewer has said, "they will rank among the most daring and felicitous in the annals of scientific discovery;" and if I may be allowed the expression of my own judgment in the matter, taken with all their adjuncts, they will prove as useful for the extension of knowledge as any scientific discoveries ever made.

Before we proceed further, however, to illustrate and prove our own theory, it may be well to examine the position which the science of the schools at present occupies on this subject. We shall do so disembarrassed of the technicalities with which scientific men have surrounded the general subject, and which, as I believe, are a bar to their own progress and discovery. It must be recollected, however, that we are not discussing the general principles of magnetism, or its abstract quality, nor the particular properties of magnets, or the nu-

merous experiments to which they have been subjected, and which have occupied so large a share of the attention of scientific men; our subject limits itself and all inquiry to that paramount law, which, local and disturbing influences apart, at all times and in all places claims the direction of the needle to the Pole. We must therefore confine our remarks to what is at present understood in the schools in respect to this branch alone of magnetic phenomena.

From the earliest date of discovery of any change in magnetic attraction, it became a subject of inquiry by what law these changes were governed. For a very long time knowledge was confined to the observations of a few individuals in limited spheres; and these served little purpose except to establish the fact that changes were taking place, but without being able to assign any reason for it. Explorers and navigators finally became the largest contributors to the knowledge of the world on this subject. By visiting almost every accessible part of the globe, and reporting their observations at home, a vast amount of facts were furnished for the use of investigators; as these discoveries increased, the manifest importance of the subject enlisted the aid of governments in the interest of the schools, and the last half century has witnessed a more extended effort than ever before, if possible to discover the laws of polar attraction. For this purpose the observations of all time have been brought together, and the minds of eminent men have been engaged, to see what results could be obtained from the facts thus collected.

These results can be soon stated. It has been discovered that there is a line surrounding the globe, bisecting the terrestrial Equator at an angle of twelve or fourteen degrees, which they have called the Magnetic Equator. It is that line where the needle has no inclination or dip, but rests perfectly horizontal. It requires the minutest possible observation to be able to locate it within a degree or more of latitude.

As at present indicated, it passes over the wide continent of Africa, where no observations at all have been had. It passes over the widest portion of South America, where very few observations have been had, and it passes over the kingdom of Siam and the Island of Borneo, where there have been no surveys at all. To supply the deficiency of observations over all these regions and wide intermediate tracts of ocean, other means were resorted to in their endeavors to locate the Magnetic Equator throughout. It was discovered that the inclination or dip of the needle increased in nearly

a regular progression as we proceed northward from the line of the Equator towards the Magnetic Pole, and this fact was made use of with apparent good judgment to assist in determining the locality of the Magnetic Equator, and consequently also of the Magnetic Pole. But when, by careful calculation from all the premises and ascertained facts at hand, the Equator was supposed to be determined, it was found to be no Equator at all—that it was wholly irregular and without symmetry, and hence of no use whatever in determining any truth relatively to itself or to the Magnetic Pole. Nothing discouraged, however, by the want of success, the eminent men and scholars engaged in the work have enlarged their labors; they have collected together all the observations made to this end in every part of the world, both those which are recent and for a long series of years past; they have divided the globe into eastern and western hemispheres, in reference solely to the east and west variations of the needle, and they have covered the globe as it were with the lines produced from the observations so collected; but all without success to discover a law which should govern polar attraction and thus point to the Pole itself.

The same course of reasoning is still being pursued, and scientific men in Europe and America are engaged in collecting new observations, and drawing lines as deduced therefrom—lines of declination, of inclination, and intensity—lines parallel, convergent, and divergent—lines in fact of every imaginable name and description, with a view to determine accurately the position of the Magnetic Equator at any given time with its corresponding Pole, and the laws which govern their changes as observed from time to time; and I need not say that all this has been without success for the objects intended. The only positive knowledge which these exertions have given us, is a knowledge of the facts which explorers have communicated, but with no law whatever to govern them;—no two theories agree in their results. Humboldt, who may be supposed to have been among the most learned in theory, placed the Magnetic Pole by calculation in latitude 79° north and 27° west, almost at the same time when Ross found it by practical observation to be situated approximately in 70½° north and 96° west. Where there is so great a discrepancy between fact and theory, there is necessarily a fundamental error either in the theory itself or in its manipulation.

Whatever of truth and sound reason there may be in the use made by scientific men (and there is, no doubt, very

much of both) of the facts in their possession in this regard, their inevitable failure from inherent causes to arrive at true results is, I think, manifest.

First.—Because the facts from which they reason, for want of means to distinguish, necessarily include the disturbances due to the sensitiveness of the needle, but which do not belong to the law of polar attraction.

Second.—The changes going on are such that, with their method of applying facts, that which was true a year ago is not true at the same point to-day.

Third.—Many, and indeed most of the facts collected together, and which form the material of their work, are facts determined by observations made by different persons, and at different times, so wide apart, that, although all of them were perhaps true at the time and place of observation, yet only one of them could be true at the same time, and not one of them is exactly true to-day.

Fourth.—It is self-evident, I think, that no true result can ever be arrived at by the method of imaginary lines, unless the facts on which such lines are based could be determined in all parts of the world at the same time, which has never been done and does not admit of a possibility.

In all the experiments of scientific men, they have regarded the Earth as the source of magnetism. Not a half century ago, many of them considered the Earth as a fixed magnet, and all magnetic influence was referred to that cause; but the changes observed contradicted that idea, and they have latterly imagined magnetic veins running through the Earth, which they have endeavored to trace by lines drawn upon its surface. To account for the changes going on, these veins have been supposed to be shifting, so as to accommodate the veins to the changes. Some have gone so far as to imagine a constant circulation of the molecules or atomic principles composing the Earth, thus producing the changes of the magnetic tendency. The celebrated Arago treated this idea with seriousness.

It has been observed that temperature, the aurora borealis, and other natural phenomena, have an influence on the magnet, and it is doubtless true; but these influences being a part of the general law of magnetism, they do not touch that

paramount law which claims the direction of the needle as soon as these influences are removed.

The Sun's heat is supposed to cause the daily vibration of the needle—the periodical return of spots on the Sun have been supposed to have an influence on the declination of the needle, and some one has suggested that the Moon has such influence also, but by *no one, before myself, has it ever been advanced that the cause of polar attraction is wholly astronomical.*

I have thus given as full and true a statement of the condition of science in the schools on the subject of polar magnetism as our limited time and space will permit. I would remark that revolution as a cause or accompaniment of magnetic attraction was not heard of among them till since the publication of my pamphlet in March last. Since that time the *Cornhill Magazine* of June, the *Scientific American* of October, and *Silliman's Journal* of November, have each of them published an article indicating revolution, but without any acknowledgment of my paper, though it was sent to all of them.

We now turn to our own hypothesis, as explained in the opening paragraph of this paper:

In all inductive reasoning on physical laws, there are truths in nature which may be laid down as axioms, from which the reasoning admits of no departure, and I therefore here lay down as axioms—*First*, that the laws of mechanics are the laws of nature. *Second*, that the construction of the universe, and the relations of the heavenly bodies to each other, and of our Earth to them, *is Nature herself*, and consequently in the relations of the heavenly bodies to each other, and of our Earth to them, we shall find the perfection of all mechanical laws. I think there can be no objection to these principles.

The question has been asked me by some intelligent persons, whose perceptions were not quite clear on the subject, "by what mechanical process the revolution of the Magnetic Pole around the North Pole can be accomplished by astronomical attraction." I will therefore give an illustration, which I have given before at a private reading of my first paper on the subject, and which I think explains it.

Let us suppose that the globe before us is transparent in such a way as to admit a line of light passing through it. Let us then suppose that a single ray of light, emanating from some distant centre, shall strike the globe at twelve or fourteen degrees from either Pole, and passing through the centre of the globe at an angle to its axis in a line to the

opposite side. It is seen that the ray of light will make a point on either side of the surface of the globe, each at the same distance from the geographical Poles, but at opposite angles to the globe's axis. Now let the globe revolve eastward on its axis: it is seen that the ray of light is stationary, but the points of light on the surface appear to revolve westward, while the globe is revolving eastward.

Now if you let the ray of light represent the line of attraction from the great centre around which our hypothesis assumes that the Earth is revolving, you will have a perfect mechanical idea of the revolution of the Magnetic Pole around the geographical Pole, caused by astronomical attraction, with this difference only, that whereas the ray of light appears to revolve with each revolution of the Earth on her axis, the Magnetic Pole only revolves in that period of time in which the Earth gains one complete year in moving eastward round the Sun, just as we gain one entire day when we travel eastward round the Earth, and just as the Moon, in moving eastward round the Earth, gains one revolution of the Earth on her axis, and just as the Earth, in moving round the Sun from opposite a fixed star to opposite that star again, gains one sidereal day.

Now let us observe that if the cause of the revolution of the Magnetic Pole be such as I have described, viz., attraction to a higher centre relatively to which the Earth is revolving, then *because* the Earth moves eastward on her axis and in her orbit, therefore, by the mechanical law which is our axiom in the case, the apparent revolution of the Magnetic Pole SHALL BE WESTWARD—and that the Magnetic Pole is known to have been moving westward for nearly three centuries, is a positive proof as far as it goes of the truth of our hypothesis; whereas if the Earth be the source of magnetism, as the schools teach us, this effect would be mechanically impossible. This is one of the many phenomena that confirm the truth of our theory, and we may safely ask the question, can anything be shown to the contrary sustained by an equal mechanical test of its truth?

The irregularities heretofore observed in the variations of the needle (and I would include *inclination* with *declination*) which have baffled inquiry, and led to the conclusion by many, that it was not governed by any law definable by reason, are, in my judgment, when examined upon their merits and aside from local and disturbing causes, a perfect evidence of the revolution of the Magnetic Poles, their equable motion through space, and the astronomical influence controlling

their apparent motion. I will mention a few facts illustrative of that view, and in doing so I will keep to the axiom of mechanical truth and necessity.

London is situated in latitude 51° north, and the present declination of the needle there is about 20½° west. The Island of New Nantucket or Baker's Island in the Pacific is in longitude 176° west, nearly on the opposite side of the globe from London, and in latitude 13′ 30′′ north,—the variation or declination there in 1866 was 9° 30′ east, or less than half that at London. Why then, being so nearly on the opposite meridian to London, has it not the same amount of variation east that London has westerly? Chiefly for the reason that being farther south, if a circle be described from each centre (London and Baker's Island) through the Pole, the radius of the circle described from Baker's Island is more than twice as long as that described from London, and the length of a degree in the circumference of such circle is more than twice as great, and consequently, the Poles being nearly fixed points, the variation is less than half as great at Baker's Island as at London.

Again, we suppose the Magnetic Pole to revolve in about 76° north. London is situated in 51° north and New York in 41° north. We at New York are therefore more than one-third farther from the line traversed by the Magnetic Pole than London is—consequently, for the reasons explained above, the variation or declination at New York can never attain to a greater amount than something less than two-thirds of the greatest variation observed at any time at London.

The greatest westerly variation ever observed at London was in about the year 1818 equal to 24½°—the greatest therefore it can ever attain at New York will not exceed about 15 or 16° west. But if we move northward on the meridian of New York to the latitude of London, the variation there (local causes aside) will always be precisely the same as at London whenever that point stands in the same position as London relatively to the Magnetic Pole, and will attain to the same extent as the greatest observed at London (24½°) whenever the Magnetic Pole shall reach the meridian of 90° west of it.

Again, it will be evident that although the Magnetic Pole moves through its orbit with a nearly equal motion (and entirely so except the small daily and yearly revolution), yet the variation of the needle changes much more rapidly at some times than at others at the same point, and very un-

equally at different points at the same time. The cause is easily seen. Whenever the Magnetic Pole is on any particular meridian, as of London, for example, it moves almost at a right angle to that point, and the variation increases rapidly; but before the Magnetic Pole reaches the meridian of 90° from the point of starting it moves at an angle so small relatively to the point of observation, that any increase of variation is scarcely perceptible, and as the change of variation becomes slower at London it becomes faster at New York. We have but to trace the motion of the Poles on the lines of the globe to have ocular demonstration of all these truths.

Similar apparent discrepancies exist in regard to *inclination* as well as the "variation" or declination, and from not dissimilar causes.

It has been quoted to me, for example, that my theory of the revolution of the Magnetic Pole cannot be true, because from the records of the observed *inclination* at London it had changed but little more than 6° in 140 years, and at that rate it would take 7,900 years to complete a revolution; but if we examine the mechanical effect of inclination upon the principle of the revolution of the Magnetic Pole, we shall soon see what inclination has to do with the latter. Inclination in north latitude is simply the downward tendency of the north end of the needle, which increases in a ratio not exactly determined as we proceed northward from the line of no inclination towards the Magnetic Pole. At the Pole the inclination is 90°.

Now, on the supposition of the revolution of the Magnetic Pole, it is self-evident that the inclination at London will be greatest when the Magnetic Pole is nearest, and least when it is farthest off. The Pole will be nearest when it is on the meridian of London, and farthest off when on the meridian of 180° from London.

As the Pole moves westward from the meridian of London, variation or declination will begin at zero and increase, and *inclination* will begin from its maximum point to diminish until the Pole reaches 90° of longitude, when variation will begin to diminish, and both *variation* and *inclination* will go on diminishing until the Pole reaches 180°. Thus we see that in obedience to the requirements of revolution, inclination has been diminishing at London from 1740 (the earliest record) to the present time. It must continue to diminish till about 1983, when the Pole shall reach 180° west from London. It will be seen also, that from the maximum to the

minimum of inclination indicates half a revolution of the Magnetic Pole, and from the minimum to the maximum the other half; but the maximum at London can never reach 90°, because London is never at the Magnetic Pole, and the minimum can never descend to zero, because London is never 90° of a circle of the globe from the Magnetic Pole.

These remarks might be continued almost indefinitely, and with appositeness to the case; but I trust that I have said enough to show that the seeming irregularities which have heretofore baffled inquiry, are in fact a necessity, and perfectly regular when applied to the revolution of the Magnetic Pole, and their existence is therefore the best proof we can have of the truth of our theory, so far as a perfect explanation of their apparent irregularities is concerned.

But our principles involve much higher truths than the apparent irregularities of magnetic attraction, which it is proper that we should state here. They claim that magnetism and the attraction of gravitation are identical *in fact*. They are known to be so in the *degree* of their forces, and since nothing whatever is professed to be known of what causes gravitation, and since by its equality of force magnetism is seen to be capable of doing all that gravitation is supposed to do, the evidence is all in favor of their identity.

Secondly.—Our principles involve the necessity that all planets are magnetic, and hence their attraction one to another, and hence that attraction towards the Earth which governs the revolution of the Magnetic Pole.

The Earth being a planet and magnetic, it is justifiable to assume that other planets are magnetic also. I think their relative motions and reciprocal influences demonstrate this truth, and if magnetism and gravitation are identical, it is impossible to be otherwise.

Our Earth, on which we reside, is a lower order of planet —it is a centre to itself and to its own satellite, but to none else. All motion from that centre is therefore necessarily outward from that centre, onward and upward in an ascending ratio from the lower to the higher; as, of the Earth on her axis, the Moon about the Earth, the Earth and Moon together about the Sun, and the Earth, Sun and Moon about a higher centre. In obedience to the axiom of mechanical law, the ascending ratio must also be in strict geometrical progression, for geometry is neither more nor less in this case than exact mechanical proportion. Geometry is pure mechanics, and the one cannot be separated from the other. The period of the Earth, Sun, and Moon is the third in the

ascending ratio as above named, and consequently the third also in geometrical progression. These facts being admitted, we are prepared to prove the period of the revolution of the Magnetic Pole by proving the period of the Earth's revolution relatively to the highest centre to which in her various revolutions she is immediately related.

In my work on the Quadrature, published in 1851, after demonstrating the circumference and diameter of one primary circle to be as 20612 to 6561, and the motion of three gravitating bodies to be as four to three of one primary circumference, I then establish the following geometrical proportion, viz.: "As one primary circumference of a circle is to the Moon's time round the Earth, so is the Moon's time round the Earth to the Earth's time round the Sun (see the Quadrature, page 114 in practical questions, and proposition 4, page 130); and the proportion stands thus: (the Moon's time round the Earth being 27.482666+) 20612 : 27482666 :: 27482666 = 366.43555, which, pointing off three figures for units in consequence of the increase of diameter of the circle, is the number of revolutions the Earth performs on her axis in revolving about the Sun (the time being circular time), and this period it will be seen is the second in the order of ascension as we have before described. The *third*, which *is our period* of the revolution of the Magnetic Pole, will then stand as follows: 20612 : 366.43555+ :: 366.43555+ = 651.4409+, the revolutions *being years* instead of *days*, and this I believe to be the exact period of the revolution of the Magnetic Pole around the Geographical Poles of the Earth.

The brevity of this demonstration will not probably suit the judgment of those gentlemen learned in astronomical science as at present taught, who, following the angular system of their predecessors of more than twenty centuries, have developed nothing definitely relative to any period such as we have here given. We must, therefore, for our own satisfaction as well as theirs, examine this period a little more minutely, that we may see what is its significance apart from and beyond its government of the motions of the Magnetic Pole.

As I have said in my last published paper on this subject, "this is not the Sun's period—that, of course, is much greater." The question then comes home with force, what period is it? and I answer, that it is the EARTH'S SYNODICAL PERIOD—a period never calculated, if indeed at all considered by astronomers—a period in which the Earth as a satel-

lite of the Sun repeats on a grander scale exactly the same phenomenon which our own satellite the Moon performs every time she makes a complete revolution of the Earth relatively to the Sun's centre.

In this period the Moon having the Earth for the centre of her orbit, and starting from a point where she conjoins the Sun's centre (which is the centre of the Earth's orbit) with any given meridian on the Earth, she pursues her journey round the Earth till she conjoins with the Sun's centre and that same meridian again; and this is her synodical period. She conjoins with no two meridians, however, at the same instant, but with every meridian on the Earth's surface in the course of one revolution of the Earth on her axis; and this is the highest revolution of the Moon which is exclusively her own, and once completing this, she goes on repeating it forever, following the Earth round the Sun.

So also the Earth having the Sun for the centre of her orbit, and starting from a point where she conjoins with any given meridian crossing the Sun's equator and the centre of the Sun's orbit, she pursues her journey eastward round the Sun till she conjoins with the centre of the Sun's orbit, and that same meridian on the Sun's surface again. And this is the Earth's synodical period in revolving about the Sun. She conjoins with no two meridians, however, on the Sun at the same instant, but with every meridian in the course of one revolution of the Sun on his axis; and this is the highest revolution of the Earth which is exclusively her own. After this she goes on repeating the same forever, following the Sun in his orbit round his great centre.

We have given the Earth's synodical period as 651.4409+ years.* The Moon performs her synodical period round the

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* From the solution of the problem of three gravitating bodies as shown by the Quadrature, pages 100 to 116, there results a series by which the Earth's synodical period is reached as the fourth in order from one primary circumference, the same as it is the third in order by geometrical progression.

For example, let C be the primary circumference of a circle (20612.), then C plus $\frac{1}{3}$=D plus $\frac{1}{3}$=E plus $\frac{1}{3}$=F plus $\frac{1}{3}$=G. Then G=651.4409+, which, pointing off three figures to the left for years, is the Earth's synodical period.

To show the direct connection of this series and this period with solar time, take the following example: Let C=1, then C plus $\frac{1}{3}$=D plus $\frac{1}{3}$=E plus $\frac{1}{3}$=F plus $\frac{1}{3}$=G, then G=3.160493+to infinity. Now G is found to be exactly equal to the circumference of one solar day in its relation to the circumference of one diameter; hence G×5153, the area of one primary circle, and ÷5184, the unit of one solar day as evolved by the multiple 6, will give 3.1415942+ to infinity, equal to the decimal circumference of one diameter. It is therefore competent from this series to produce the circumference of one

Earth in a little more than twenty-nine and a half revolutions of the Earth on her axis from opposite the sun's centre to opposite that centre again, or twenty-nine and a half solar days (it is 29.530588+).

If therefore we give to the Sun the same number of revolutions on his axis, relatively to the centre of his orbit, from one conjunction to another (and he can have neither more nor less without breaking the order of revolution), it will prove that the Sun revolves on his axis relatively to the centre of his orbit once in twenty-two years and twenty-one days. Any fixed spot on the Sun's disc will therefore return in eleven years and ten and a half days from the time of its disappearance, or in half a revolution of the Sun on his axis relatively to the centre of his orbit. Herschell in his Astronomy gives the periodical return of the Sun's spots as eleven and eleven one-hundredths years—equal to eleven years and thirty-nine days. Herschell did not claim to know anything of the period which we are endeavoring to prove; but the coincidence of time of the return of the Sun's spots abundantly proves its truth. But as the Sun's individual spots are not clearly identified, and some may doubt the entire accuracy of time, we will not rest our evidence here—we have a more sure testimony in what follows.

The Sun appears to revolve on his axis relatively to us in twenty-six or twenty-seven days. It is therefore certain that the above revolution of plus twenty-two years relatively to the centre of his orbit must be accomplished by a small daily procession over mean or sidereal time. Herschell gives the Sun's synodical period on his axis (*i. e.* relatively to the Earth and the Moon) as $27^d\ 5^h\ 5'$. The Moon's sidereal time round the Earth is $27^d\ 7^h\ 43'\ 3''$; at that rate, therefore, according to Herschell, there is a precession of the Sun on his axis of $2^h\ 38'\ 3''$ in a sidereal lunation. We have thus the right amount of the Sun's precession in his axial motion relatively to us to conform to the period of 22+ years relative to the centre of his orbit. More exactly I think the amount of that precession is $5'\ 43''\ 32'''$ daily, equal to $2^h\ 36'\ 25''$

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diameter from any number whatever, and to any number of places of figures required, and with the use of any equal multiple or divisor of the primary circle and the solar day. This series may also be made a perfect test of the truth of my ratio of circumference and diameter, and of the deficiency of geometers' ratio which it is not in the power of numbers or geometry to disprove. Many of these things, which are considered by mathematicians as mere curiosities of figures, are in fact mechanical truths of the very highest order.

57′′′ in a sidereal lunation, differing from Herschell's period but 1′ 37′′ in a lunar month.* At that rate of motion, in plus twenty-two years, the Sun by his precession will gain one complete synodical period of the Moon and one precession added; and the Earth, having passed twenty-two times round the Sun, will have gained of solar time twenty-two times the amount of one precession of the Sun on his axis, the whole together equal to $32^{d}\ 0^{h}\ 51.'$ This is just as it should be; the motion is perfectly mechanical, and the time agrees with Herschell's demonstration of the Sun's precession within a few minutes in plus twenty-two years. Neither one of these phenomena could exist without the other—they are in fact creative of each other; the existence of the period creates the precession, and the existence of the precession proves the necessity of the period.

I consider the evidence perfect in itself, and it is therefore certain, I think, that plus 651 years is the Earth's synodical period, and that the sun turns on his axis relatively to the centre of his orbit once in plus twenty-two years, in which, revolving about the Sun, the Earth conjoins with any meridian on the Sun, and the centre around which the Sun revolves. The fact that this same period is or is not also the period of the revolution of the Magnetic Pole turns wholly upon the admission or denial whether or not the attraction of the needle is caused by astronomical or planetary influence. If that be admitted, it is then an absolute necessity that the superior attractions which govern the Earth's motions relatively to the Sun and the centre of his orbit, must also govern the movement of the Magnetic Pole.

If I understand correctly the principles and necessities of combined motion, these orbs revolving together and about each other, all governed by the same laws, and their forces all equalized between themselves in respect to their relative magnitudes, distances, and velocities, can no more fail to make these conjunctions in the ascending and progressive order exactly as begun, without getting out of place in respect to each other, than the hands of a clock can fail to con-

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* Whatever difference there may be in the relative motions of the Sun on his axis and of our Earth, it being the primary of all relative motions, it can be neither more nor less than unit, and the unit of circumference irrespective of magnitude is 20612, which expressed in the divisions of time=5′ 43′′ 32′′′, which I assume, therefore, is the true difference in the relative motions of the Sun and our Earth on their respective axes; and I prefer this as a principle of motion rather than the result of Herschell's instrumental observation, which, like all other observations, is at best only a very close approximation.

XUM

join at 12 M. without getting out of place in respect to time. The perfect observance and exact fulfilment of this order is in fact a part of the law which keeps the Earth in her perfect balance, fulfilling her seasons in exact time, and with perfect safety.

I must here ask attention to the fact that in proving the exact period of the revolution of the Magnetic Pole, I have at the same time explained and proved the Earth's synodical period—a period not before known or understood in the science of the schools—and this is done chiefly by the aid of the Quadrature, so long condemned by the schools as a useless question.

I consider the evidence perfect in itself; yet I have no doubt but it will be rejected by those who contend for the orthodox and angular system of demonstration, which in my opinion is incompetent to discover the truth in either case. The true and immediate reason of its rejection, however, will be, that its simplicity and truthfulness to nature does not flatter the ostentatious pretensions of speculative learning. *Victory*, however, will not always hang in the balance, but must eventually be declared on the side of truth.

There is another truth of Astronomy with which this period has something to do—it is the precession of the equinoxes.

Two forces are always active in revolution; and in order that revolution may be continuous it is necessary that one of the forces should always precede the other a little. Wherever there is continuous revolution, therefore, there is always a precession of one of the forces which govern it. It is a universal principle and a mechanical law, without which motion cannot be continued. It may be best illustrated by the steam-engine, and it is just as observable and necessary in the motion of the heavenly bodies as in the steam-engine.

In the construction of the engine one of the first difficulties encountered was to overcome the force of gravity. It was found that when the two forces of gravity and steam-power came exactly opposite each other the engine stopped. Something was wanted to carry forward motion beyond the centre of gravity, and this is exactly the same thing as precession in the motion of the heavenly bodies. Ingenuity and perseverance at length overcame the difficulty with the steam-engine, and it is a remarkable fact and worthy of attentive consideration, that the principle by which the difficulty is overcome is precisely the same as is observable in the relative motions of our Earth and the heavenly bodies, viz.: by a slight difference in

time in the action of one of the forces,—a moment's precession of one force over the other. Thus, as we have just now seen, the Sun, the source of the governing attraction in his revolution on his axis, takes precession of the Moon in his orbit more than five minutes daily, and fulfils his revolution more than two hours sooner in a lunar month than the Moon completes her orbit relatively to a fixed star.

The Earth appears to be moving between two forces—the attraction of the Sun as the centre of the solar system to which the Earth belongs, and a force outside of the solar system which controls and limits the sidereal or mean year. But in the motions of the Earth the Sun's attraction always takes precedence, or has the precession, because, as I suppose, that the Earth is nearer to him than to the opposite force, and because the Earth undoubtedly belongs to the Sun's system.

Thus, while the Earth is turning on her axis, the Sun actually goes before, and the Earth is nearly 3′ 56″ longer in turning on her axis from opposite the Sun's centre to opposite that centre again, than she is in turning from opposite a fixed star to opposite that star again. The Earth in her daily revolution is thus carried forward beyond the gravitating centre of the two forces, the solar and sidereal, and the amount which she is thus carried forward is the Sun's daily precession.

Again, in the Earth's revolution round the Sun the Sun arrives at his solstitial points nearly forty-five seconds before the star arrives at the same meridian, and the solar year is ended before the sidereal year is ended; and this again is the Sun's annual precession at his solstitial points over sidereal time, or the mean year.

So also the Sun arrives at his equinoctial points about 3½ seconds of time and plus 51″ of a degree before the star arrives at the same meridian, and this is what is termed the "precession of the equinoxes," in which, according to *our* theory, the Sun by his precession carries the Earth beyond the centre of gravity of the two forces which govern her motion; and this precession will surround the globe in about 25,000 years, sometimes called the great year of the Earth.

We are now to see what our period of the revolution of the Magnetic Pole and the Earth's synodical period has to do with the precession of the equinoxes.

In my work on the Quadrature, pages 97 to 99 inclusive, I have shown that "all periods of time are greater than the

revolution of one primary circle in space, because all the heavenly bodies by which time is measured are themselves also in motion." The revolution of one primary circle in space when reduced to time is 23h. 51′ 23′′ 20′′′— and the sidereal revolution is the exact mean between one circular and one solar day, less 44′′ 52′′′, which is the Sun's precession at his solstitial points. In other words, the excess above the mean between a circular and sidereal and a sidereal and solar day is the Sun's precession at his solstitial points.*

As the Earth's synodical period is the same revolution as her annual period, only continuous for a longer time, and relatively to a higher centre, which is on a scale of geometrical progression above the annual period, it is, therefore, evident that the Sun's daily precession in the Earth's synodical period shall be the *mean of the difference* between a circular and sidereal and a sidereal and a solar day, and any excess of the actual period above the mean of such *difference*, shall be the Sun's precession at his equinoctial points. In this we follow the exact rule as seen to exist in the annual revolution and the Sun's precession at his solstitial points.

The actual mean as described above, is found by calculations to be 2′ 9′′ 10′′′ solar time,† and the actual time of the Sun's daily precession in the Earth's synodical period is 2′ 12′′ 37′′′ +;‡ the difference above the mean is 3′ 27′′′ +,

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* The solar day equals 24 hours, difference greater than circular day ..... 8′ 36′′ 40′′′
The sidereal day equals 23 h. 56′ 4′′ 6′′′, difference less than solar day 3 55 54
The circular day equals 23 h. 51′ 23′′ 20′′′, difference less than sidereal day 4 40 46
Excess of difference above the mean ..... 0′ 44′′ 52′′′

† The difference between one circular and one sidereal day is 4′ 40′′ 46′′′, half equals ..... 2′ 20′′ 23′′′
The difference between one sidereal and one solar day is 3′ 55′′ 54′′′, half equals 1 57 57
Together = ... 4′ 10′° 20′′′
Half equals 2 9 10

‡ The period 651.4409 + × 365.24225 +, the days and fractions of days in the mean year, gives the product 237933.74 +, equal the number of solar days in the whole period; and this product 237933.74 + divided into the mean year reduced to the smallest appreciable divisions of time (thirds, or 60ths of a second) will give the required Sun's precession daily to accomplish the whole revolution. Thus, 651.4409 + × 365.24224 = 237933.74 + and 365 d. 5 h. 48′ 50′′ 53′′′ reduced to its lowest denomination = 1893415853 ÷ 237933.74 = 7957.74 +, which is the amount of the Sun'

which is the Sun's daily precession above the mean as before stated; and because in performing one complete revolution round the Sun, the Earth has gained one entire revolution on her axis from the Sun to the Sun, or one solar day, therefore the Sun, on the completion of the full year, arrives at his equinoctial point preceding the star by exactly the excess (3″ 27‴ +) of the whole daily precession above the mean of the DIFFERENCE between a circular and sidereal and a sidereal and solar day, as before stated,—just as at his solstitial point, the Sun precedes the star by exactly the excess above the mean between a circular and sidereal and a sidereal and solar day.

The calculations by which these results are reached are perfectly simple and reliable, but the detail of figures would be too dry for rehearsal here, although some very curious and interesting facts might be developed thereby.*

The precession of the equinoxes is therefore seen to be the natural and necessary result of the mechanical laws of motion, and not the result of accidental and extraneous causes, as has been taught by astronomy.

To speculate on the cause of an observed phenomenon and make a show of reason out of it is one thing, and to demonstrate the necessity of such phenomenon, its cause and exact value by a mechanical law of universal application, is quite another thing. And this is the real difference between me and the astronomers of the schools in regard to the cause of the precession of the equinoxes.

In my last published paper on this subject I said that "problems of new and exceeding interest, almost without bound, would follow the acceptance of the truth of my demonstrations." As yet I have scarcely touched upon their number or interest; others of a more startling nature than any yet mentioned, and not less clear and conclusive, are in reserve, and ready to be demonstrated whenever the principles of revolution and the value of the quadrature are admitted. These demonstrations will contradict no *known* truth, but they will add many new truths to those already known. As in the case of the precession of the equinoxes, they will set aside some of the speculative causes of the ob-

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daily precession over mean time, the time being in thirds or 60ths of a second, and 7957‴ + expressed in the proper divisions of time = 2′ 12″ 37‴ +, the Sun's actual daily precession in the Earth's synodical period.

* The elements of the exact period of the Sun's orbit are, I think, developed in these calculations, which I am induced to believe is exactly 25,000 years, but with a lap or precession at the end indicative of another revolution that will take over 13,000,000 years to fulfil.

served phenomena, and substitute in their room a natural and efficient cause. They will correct false theories; and no one need be surprised if, in a very short time from this, astronomers should find themselves compelled to inquire whether they have not always been mistaken in supposing the unnatural existence of a projectile force.

Sir J. F. W. Herschell in his Astronomy has remarked that "Astronomy, unlike the other sciences, can never change" His meaning doubtless was, that the truths of astronomy were fixed from eternity in the laws of nature, and therein he was right, and astronomy can never change. But some who have not Herschell's perceptions of truth, have construed him to mean that the science of astronomy as taught, being already perfect in itself, can suffer no change. But this is a very great mistake. There are many things taught as truths in astronomy which are purely conjectural. I speak not now of any of the observed phenomena, but of the causes assigned for such phenomena, which are often accepted by the learned only for want of a better explanation; and if my demonstration be true, such has been the case in regard to the precession of the equinoxes; by attributing it to a wrong cause they have been led into another error to find the cause of nutation. I believe that if the principle be accepted, that the Magnetic Pole revolves by astronomical attraction—gradually, but very slowly, changing the equator and the poles—it will at once explain all those curvilinear phenomena about the Poles of the Ecliptic, which have led to the assumed cause of precession and nutation. Precession and the appearance of nutation will still exist, but the cause of them will be quite another affair. They are simple, natural, and mechanical truths, the result of a compound motion.

I do not believe the story which the savans tell us to account for precession and nutation,—that this Earth of ours, which bears us all so kindly and smoothly on her bosom, is in fact a hump-back, and that she wags herself lewdly in presence of her lord the Sun when he approaches the equator. I am satisfied that she has no such deformity or infirmity, and that she will at length vindicate herself against all such aspersions of vain and presumptuous philosophers.*

* It is held by astronomers that the cause of the precession of the equinox is an accumulation of matter and protuberances of the Earth about the equator,—and that the attraction of the Sun and Moon acting upon the increased mass, gives to the Earth a disturbed motion, causing a vibratory movement on her axis, and this they call nutation or a *nodding*. I have no belief in such a cause.

VI.—*Volcanoes and Earthquakes. Abstract of a Lecture by* T. Sterry Hunt, LL. D., F. R. S.

Delivered April 22, 1869.

It is proposed in the present lecture to discuss the nature and causes of volcanoes and earthquakes, with their related phenomena, and to consider the reason of their peculiar geographical distribution. Violent movements of the earth's crust are confined to certain regions of the globe, which are at the same time characterized by volcanic activity; from which it is reasonably inferred that the phenomena of earthquakes and volcanoes have a common origin. The discharge through openings in the earth's crust of ignited stony matter, generally in a fused condition, and the disengagement of various gases and vapors, accompanied by movements of elevation or subsidence of considerable areas of the earth's surface, sometimes rapid and paroxysmal, and attended with great vibratory movements, are evidences of a yielding crust of solid rock resting upon an igneous and fluid mass below. To the same conditions are also to be ascribed the slow movements of portions of the earth's surface shown in the rise and fall of continents in regions remote from centres of volcanic activity. The unequal tension of the yielding crust and the sudden giving way of the overstrained portions are probably the immediate cause of earthquake phenomena; the seat of these, according to the deductions of Mallet, is to be found at depths of from seven to thirty miles from the surface.

A brief description of the phenomena of volcanoes will be necessary as a preliminary to the inquiry which constitutes the object of our lecture. Volcanoes are openings in the earth's crust through which are discharged solid, liquid, and gaseous matter, generally in an intensely heated condition. Sometimes the ejected material is solid, and consists of broken comminuted rock, or the so-called volcanic ashes. Oftener, however, it is discharged in a more or less completely fused condition, constituting lava, which is sometimes fluid and glassy, but more frequently pasty and viscid, so that it flows slowly and with difficulty. The ejected

materials, whether liquid or solid, build up volcanic cones by successive layers—a fact which has been established by modern observers in opposition to the notion come down from antiquity, that volcanic hills are produced by an uprising or tumefaction of previously horizontal layers of rock by the action of a force from beneath. First among the gaseous products of volcanoes is watery vapor; water appears not only to be involved in all volcanic eruptions, but to be intimately combined with the lavas, to which, as Scrope has shown, it helps to give liquidity. The water at this high temperature is retained in combination under great pressure but as this pressure is removed passes into the state of vapor, a process which explains the swelling up of lavas and their rise in the craters of the volcanoes. Besides watery vapor, carbonic and hydrochloric acid gases, and hydrogen, both free and combined with sulphur and with carbon, are products of volcanoes. The combustion of the inflammable gases in contact with air sometimes gives rise to true burning mountains—a name which does not properly belong to such as give out only acid gases, steam, and incandescent rocky matters, which are incombustible. The escape of elastic fluids from lavas gives to them a cellular structure, but when slowly cooled under pressure, as seen in the dykes traversing the flanks of volcanoes, the stony materials assume a more solid and crystalline condition, and resemble the older eruptive rocks found in regions not now volcanic. These include granites, trachytes, dolerites, basalts, etc., and are masses of rock which, though extravasated after the manner of lavas, became consolidated in the midst of surrounding rocks, and consequently under considerable pressure. Their presence marks either the lower portions of volcanoes whose cones have been removed by denudation, or outbursts of liquefied rock which never reached the surface. The escape of such matters, and the formation of volcanic vents, are but accidents in the history of the igneous action going on beneath the earth's surface. We shall, therefore, regard the extravasation of igneous matter, whether as lava or ashes at the surface, or as plutonic rock in the midst of strata, as, in its wider sense, a manifestation of vulcanicity, and for the elucidation of our subject consider both those regions characterized by great outbursts of plutonic rock in former geologic periods, and those now the seats of volcanic activity, which, in these cases, can generally be traced back some distance into the tertiary epoch. To begin with the latter, the first and most important is the great continental region which

may be described as including the Mediterranean and Aralo-Caspian basins, extending from the Iberian peninsula eastward to the Thian-Chan Mountains of Central Asia. In this great belt, extending over about 90° of longitude, are included all the historic volcanoes of the ancient world, to which we must add the extinct volcanoes of Murcia, Catalonia, Auvergne, the Vivarais, the Eifel, Hungary, etc., some of which have probably been active during the human period.

It is a most significant fact that this region is nearly coextensive with that occupied for ages by the great civilizing races of the world. From the plateau of central Asia, throughout their westward migration to the pillars of Hercules, the Indo-European nations were familiar with the volcano and the earthquake; and that the Semitic race were not strangers to the same phenomena, the whole poetic imagery of the Hebrew Scriptures bears ample evidence. In the language of their writers, the mountains are molten, they quake and fall down at the presence of the Deity, when the melting fire burneth. The fury of his wrath is poured forth like fire; he toucheth the hills and they smoke, while fire and sulphur come down to destroy the doomed cities of the plain, whose foundation is a molten flood. Not less does the poetry and the mythology of Greece and of Rome bear the impress of the nether realm of fire in which the volcano and the earthquake have their seat, and their influence is conspicuous throughout the imaginative literature and the religious systems of the Indo-European nations, whose contact with these terrible manifestations of unseen forces beyond their foresight or control, could not fail to act strongly on their moral and intellectual development, which would have doubtless presented very different phases had the early home of these races been the Australian or the eastern side of the American continent, where volcanoes are unknown, and the earthquake is scarcely felt.*

Besides the great region just indicated, must be mentioned that of our own Pacific slope, from Fuegia to Aliaska, from

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* Compare the fine lines of Pope, in the Essay on Man, where, of superstition, the poet says:

"She, 'mid the lightning's glare, the thunder's sound,
While rocked the earthquake, and while rolled the ground,
She taught the proud to bend, the weak to pray—
To Powers unseen and mightier far than they,
She, 'mid the rending earth and bursting skies,
Saw gods descend and fiends infernal rise;
Here fixed the baleful, there the blest abodes—
Fear made her devils and weak hope her gods."

whence along the eastern shore of Asia, a line of volcanic activity extends to the terrible burning mountains of the Indian archipelago. Volcanic islands are widely scattered over the Pacific basin, and volcanoes burn amidst the thick-ribbed ice of the Antartic continent. The Atlantic area is in like manner marked by volcanic islands from Jan Mayen and Iceland, to the Canaries, the Azores, and the Caribbean islands, and southward to Ascension, St. Helena, and Tristan d'Acunha.

The continents, with the exception of the two areas already defined, present no evidences of modern volcanic action, and the regions of ancient volcanic activity, as shown by the presence of great outbursts of eruptive rocks, are not less limited and circumscribed. In northern Europe, the chain of the Urals, an area in central Germany, and one in the British islands are apparent, and in North America there appear to have been but two volcanic regions in the paleozoic period—one in the basin of Lake Superior, and another, which may be described as occurring along either side of the Apallachian chain to the north-east, including the valleys of the lower St. Lawrence, Lake Champlain, the Hudson and Connecticut rivers, and extending still farther southward. The study of the various eruptive rocks of this region shows that volcanic activity in different parts of it was prolonged from the beginning of the paleozoic period till after its close.

Having thus before us the principal facts in the history of volcanoes, we may proceed to notice the various theories from time to time put forward to account for them. The first and most obvious notion is that of combustion, and we find early writers supposing that volcanoes might be due to the burning of coal, bitumen, or sulphur. As juster ideas were acquired of the nature of combustion, and the necessity of a supply of air for its maintenance, other chemical agencies were invoked as the probable source of internal fire. Lemery suggested the oxidation of sulphurets in the presence of water, and the brilliant discovery by Davy, in the earths and alkalies, of metallic bases which decompose water with great violence, and even with the phenomena of combustion, gave rise to the so-called chemical theory of volcanoes, which has found its defenders down to our own time. This theory supposes that the interior of the globe consists of the metallic bases of earths and alkalies, which are oxidized by the gradual access of the ocean's water, with the production of intense heat, causing the fusion of the resulting oxides,

which constitute lavas and eruptive rocks. The chemical objections which may be urged against this theory, are numerous, and to my mind insuperable; in addition to which it may be added that it fails to explain the facts connected with the past and present distribution of volcanoes, and is in disaccord with those views of the early condition of the globe most in harmony with the deductions of modern astronomy, physics, and chemistry.

I need not here repeat the arguments in favor of the theory which supposes our earth to be a cooling globe, which has passed through various stages, from an uncondensed nebulous mass to a liquid, and finally to its present solid condition, with a cold exterior; nor to the evidences of a regularly increasing temperature as we descend into its crust, from which it is concluded that at a depth of a few miles a heat of ignition would be attained. If we suppose the solidification of the once liquid globe to have begun at the surface, which became thus covered with a feebly conducting crust, it would not be difficult to admit, as some imagine, a still liquid centre, surrounded by a shell of congealed matter upon which are spread the sedimentary strata. Various and independent arguments from the phenomena of precession, from the theory of the tides, and from the crushing weight of mountain masses like the Himmalayah, have, however, been brought against this hypothesis of a thin crust resting upon a liquid centre, and in addition to these another important one of a different order. Judging from the known properties of the rocks with which we are acqainted, solidification should commence not at the surface, but at the centre of the liquid globe, a process which would moreover be favored by the influence of pressure. This augments the melting temperature of matters which, like the rocks and most other solids, become less dense when melted, while on the other hand it reduces the melting point of those which, like ice, become more dense by fusion. Pressure, moreover, it may be mentioned in this connection, increases the solvent power of water for most bodies, whose solution may be described as a kind of melting down with water into a compound whose density is greater than that of the mean of its constituents; the importance of this point will appear farther on. The theory deduced from the above considerations, and adopted by Hopkins and by Scrope, is briefly as follows: the earth's centre is solid, though still retaining nearly the high temperature at which it became solid. At an advanced stage in the solidifying process the remaining envelope of fused matter

became viscid, so that the descent from the surface of the heavier particles, cooled by radiation, was prevented, and a crust formed, through which cooling has since gone on very slowly. There were thus left between this crust and the solid nucleus, portions of yet unsolidified matter (or even perhaps, as suggested by Scrope, a continuous sheet), and it is in the existence of this stratum, or of lakes of uncongealed matter, that we are to find an explanation of all the phenomena of volcanoes and earthquakes, of elevation and subsidence, and of the movements which result in the formation of mountain chains, as ingeniously set forth by Mr. Shaler. The slow contraction of the gradually cooling globe, a most important agency in the latter phenomena, is evidently not excluded by this hypothesis. It may be added that a similar structure of the globe, viz., a solid nucleus and a solid crust separated from each other by a liquid stratum, was long ago suggested by Halley in order to explain the phenomena of terrestrial magnetism. Scrope has completed this hypothesis by the suggestion that variations in tension or pressure may cause portions of matter beneath the surface to pass from solid to liquid, or from a liquid to a solid state, and in this way help us to explain the local and the temporary nature of volcanic activity.

This theory of Hopkins and Scrope, apparently so complete in itself, is an approximation to the one which I adopt, though differing from it in some most important particulars. While admitting with them the existence of a solid nucleus and a solid crust, with an interposed stratum of semi-liquid matter, I consider this last to be, not a portion of the yet unsolidified igneous matter, but a layer of material which was once solid, but is now rendered liquid by the intervention of water under the influence of heat and pressure. When, in the process of refrigeration, the globe had reached the point imagined by Hopkins, where a solid crust was formed over the shallow molten layer which covered the solid nucleus, the farther cooling and contraction of this crust would result in irregular movements, breaking it up, and causing the extravasation of the yet liquid portions confined beneath. When at length the reduction of temperature permitted the precipitation of water from the dense primeval atmosphere, the whole cooling and disintegrating mass of broken-up crust and poured-out igneous rock would become exposed to the action of air and water. In this way the solid nucleus of igneous rock became surrounded with a deep layer of disintegrated and water-impregnated material, the ruins of its

former envelope, and the chaotic mass from which, under the influence of heat from below and of air and water from above, the world of geologic and of human history was to be evolved.

As we descend in the sedimentary crust of the earth, we observe a regular increase of temperature, due, as is supposed, to the slow upward passage of the central heat. In the present state of refrigeration this process is so slow that the increase of temperature in descending is only about one degree Centigrade for each hundred feet; but if we admit the hypothesis of a cooling globe, it can be shown that in early geologic ages this increase must have been tenfold, or even twenty-fold greater than at present. As this augmentation of temperature in depth obeys the same law alike in the newest and the oldest formations, it follows that the accumulation of sediment at any time and place will result in a slow rise in temperature of the portion covered thereby, so that a deposit of a few miles in thickness in comparatively recent ages, and probably one of as many thousands of feet in the Laurentian or even the paleozoic period, would, after a lapse of time, so elevate the temperature of the buried portions as to produce new chemical and mechanical arrangements of the sediments. The expansive action of heat upon these porous materials, which generally include several hundredths of water, would soon be counteracted by the great contraction following chemical combination, resulting in the formation of new and denser compounds, which constitute the crystalline and metamorphic rocks. The action of silicious matters in the presence of water, aided by heat, upon the various carbonates, chlorides, sulphates, and organic matters which abound in most sedimentary formations, would generate the acid gases which are so often evolved in volcanic eruptions. It must be borne in mind that water under pressure, and at high temperatures, develops extraordinary solvent powers; while from what has already been said of the influence of pressure in favoring solution, it will be seen that the weight of the overlying mass becomes an efficient cause of the liquefaction of the lower portions of the sedimentary material. Time is wanting to discuss the great forces which from early geologic periods have been active in transferring sediments, alternately wasting and building up continents. By the depression of the yielding crust beneath regions of great accumulation there follows a softening of the lower and of the more fusible strata, while the great mass of more silicious rocks becomes cemented into com-

parative rigidity, and finally, as the result of the earth's contraction, rises a hardened and corrugated mass, from whose irregular erosion results a mountainous region.

Those strata, which from their composition yield under these conditions the most liquid products, are, it is conceived, the source of all plutonic and volcanic rocks. Accompanied by water, and by difficultly coercible gases, they are either extravasated among the fissures which form in the overlying strata, or find their way to the surface. The variations in the composition of lavas and their accompanying gases in different regions, and even from the same vent at different times, are strong confirmations of the truth of this view, to which may be added the fact that all the various types of lava are represented among aqueous sedimentary rocks, which are capable of yielding these lavas by the process of fusion.

The intervention of water in all lavas, of which it appears to form an integral part, was first insisted upon by Scrope, and is a fact hardly explicable upon any other hypothesis than the one just set forth. Considering the conditions of its formation, water would seem to be necessarily absent from the originally fused globe, in which the older school of geologists conceive volcanic rocks to have their source. Scheerer supplemented Scrope's view by showing that the presence of a few hundredths of water, maintained under pressure at a temperature approaching ignition, would probably suffice to produce a quasi-solution or an igneo-aqueous fusion of most crystalline rocks, and subsequent observations of Sorby have demonstrated that the softening and crystallization of many granites and trachytes must have taken place in the presence of water, and at temperatures not above a low red heat. Keeping in view these facts, we can readily understand how the sheet of water-impregnated debris, which, as we have endeavored to show, must have formed the envelope to the solid nucleus, assumed in its lower portion a semi-fluid condition, and constituted a plastic bed on which the stratified sediments repose. These, which are in part modified portions of the disintegrated primitive crust, and in part of chemical origin, by their irregular distribution over different portions of the earth, determine, after a lapse of time, in the regions of their greatest accumulation, volcanic and plutonic phenomena. It now remains to show the observed relations of these phenomena, both in earlier and later times, to great accumulations of sediment.

If we look at the North American continent, we find along its north-eastern portion evidences of great subsidence, and

an accumulation of not less than 40,000 feet of sediment along the line of the Appalachians from the Gulf of St. Lawrence southwards, during the paleozoic period, and chiefly, it would appear, during its earlier and later portions. This region is precisely that characterized by considerable eruptions of plutonic rocks during this period and for some time after its close. To the westward of the Appalachians, the deposits of paleozoic sediments were much thinner, and in the Mississippi valley are probably less than 4,000 feet in thickness. Conformably with this, there are no traces of plutonic or volcanic outbursts from the north-east region just mentioned throughout this vast paleozoic basin, with the exception of the region of Lake Superior, where we find the early portion of the paleozoic age marked by a great accumulation of sediments, comparable to that occurring at the same time in the region of New England, and followed or accompanied by similar plutonic phenomena. Across the plains of northern Russia and Scandinavia, as in the Mississippi valley, the paleozoic period was represented by not more than 2,000 feet of sediments, which still lie undisturbed, while in the British islands 50,000 feet of paleozoic strata, contorted and accompanied by igneous rocks, attest the connection between great accumulation and plutonic phenomena.

Coming now to modern volcanoes, we find them in their greatest activity in oceanic regions, where subsidence and accumulation are still going on. Of the two continental regions already pointed out, that along the Mediterranean basin is marked by an accumulation of mesozoic and tertiary sediments, 20,000 feet or more in thickness. It is evident that the great mountain zone, which includes the Pyrenees, the Alps, the Caucasus and the Himmalayah, was, during the later secondary and tertiary periods, a basin in which vast accumulations of sediments were taking place, as in the Appalachian belt during the paleozoic times. Turning now to the other continental region, the American Pacific slope, similar evidences of great accumulations during the same periods are found throughout its whole extent, showing that the great Pacific mountain belt of North and South America, with its attendant volcanoes, is, in the main, the geological equivalent or counterpart of the great east and west belt of the eastern world.

It is to be remarked that the volcanic vents are seldom immediately along the lines of greatest accumulation, but appear around and at certain distances therefrom. The question of the duration of volcanic activity in a given re-

gion is one of great interest, which cannot, for want of time, be considered here. It appears probable that the great manifestations of volcanic force belong to the period of depression of the area of sedimentation, if we may judge from the energy and copiousness of the eruptions of island volcanoes, although the activity is still prolonged after the period of elevation.

As regards the geological importance of volcanic and earthquake phenomena, their significance is but local and accidental. Volcanoes and earthquakes are and always have been confined to limited areas of the earth's surface, and the products of volcanic action make up but a small portion of the solid crust of the globe. Great mountains and mountain chains are not volcanic in their nature or their origin, though sometimes crowned by volcanic cones; nor are earthquakes and volcanoes to be looked upon as anything more than incidental attendants upon the great agencies which are slowly but constantly raising and depressing continents.

The theory of volcanic phenomena here set forth was first partially indicated by Keferstein in 1834, and subsequently and apparently independently by Sir John Herschel in 1837. It, however, attracted little or no attention until, in 1858 and 1859, I again brought it forward, and endeavored to show its conformity with the facts of chemistry, physics, and geognosy. In the hasty sketch of it here given, the chemist, the geologist, and the geographer will alike discover points which require elucidation or provoke criticism, but will, I hope, find, nevertheless, a concise and intelligible statement of a theory of earthquakes and volcanoes which appears to me more in harmony with the known facts of science than any other hitherto advanced.

P. S.—In justice to myself, it should be said that at the the time this lecture was delivered I had no knowledge of Prof. J. D. Whitney's excellent and suggestive paper on earthquakes, which appears in *The North American Review* for April, 1869. The relation of modern volcanic phenomena to great accumulations of newer secondary and tertiary rocks, and the connection of the foldings and contortions of sedimentary strata with great thicknesses of the same, are set forth by me in several papers, the chief of which may be found in the *Canadian Journal* for May, 1858, the *Geological Journal* for November, 1859, and the *American Journal of Science* for July, 1860 (vol. xxx., p. 133), and also for May, 1861 (vol. xxxi., pages 406–414), where the important contributions of Professor James Hall, bearing upon this question, are noticed at length. T. S. H.

VII.—*Equatorial Africa, with an Account of the Race of Pigmies.* By PAUL B. DU CHAILLU.

Read February 4, 1869.

Mr. President and Gentlemen of the American Geographical Society:

The dwarfish or pigmean race that I discovered in my second journey will be the subject of the paper I am to read before you to-night. The discovery of this race must have brought to the minds of many of us the writings of Herodotus, Homer, and others. The accounts they gave us of the pigmean race were thought to be fabulous. Herodotus, however, is quite correct, while the description of Homer is not, after all, so far out of the way. The name of Herodotus shines prominent among the great names of the past. As a narrator, how careful he is to distinguish what he saw from what other people told him. Let me therefore give what he says about the pigmy race. He writes:

"I did hear, indeed, what I will now relate, from certain natives of Cyrene. Once upon a time when they were on a visit to the Oracular shrine of Ammon, when it chanced in the course of conversation with Etearchus, the Ammonian king, the talk fell upon the Nile—how that its source was unknown to all men. Etearchus, upon this, mentioned that some Nasamonians had come to his court, and when asked if they could give any information concerning the uninhabited parts of Lybia, had told the following tale: (The Nasamonians are a Lybian race who occupy the Syrtes and a tract of no great size towards the east.) They said there had grown up among them some wild young men, the sons of certain chiefs, who, when they came to man's estate, indulged in all manners of extravagancies, and, among other things, drew lots for five of their number to go and explore the desert parts of Lybia, and try if they could not penetrate farther than any had done previously. (The coast of Lybia along the sea which washes it to the north throughout its entire length from Egypt to Cape Soloeis, which is its farthest point, is inhabited by Lybians of many distinct tribes, who possess the whole tract except certain portions which belong to the Phœnicians and the Greeks.) Above the coast line and the country inhabited by the maritime tribes, Lybia is

full of wild beasts; while beyond the wild beast region there is a tract which is wholly sand and very scant of water, and utterly and entirely a desert. The young men, therefore, dispatched on this errand by their comrades, with a plentiful supply of water and provisions, travelled at first through the inhabited region, passing which they came to the wild beast tract, whence they finally entered upon the desert, which they proceeded to cross in a direction from east to west. After journeying for many days over a wide extent of land, they came at last to a plain where they observed trees growing; approaching them and seeing fruit on them, they proceeded to gather it; while they were thus engaged there came upon them some *dwarfish men under the middle height* who seized them and carried them off. The Nasamonians could not understand a word of their language, nor had they any acquaintance with the language of the Nasamonians. They were led across extensive marshes, and finally came to a town where all the men were of the height of their conductors and black-complexioned. A great river flowed by the town, running from west to east and containing crocodiles. Etearchus conjectured this river to be the Nile, and reason favors this view."

Little did I dream when first exploring the country that I should eventually discover what I now think to be the dwarfs described by Herodotus, nearly two thousand three hundred years before. The size of these dwarfs, as given by him, agrees entirely with the height of the people that I discovered. They were under middle height.

The Nasamonians, says Herodotus, were led across extensive marshes to a forest; but we are not told if the marshes were not in the forest.

I will now give the passage of Homer, from the very faithful translation of Cowper; it is as follows:

> "Such clang is heard along the skies when, from incessant showers
> Escaping, and from winter's cold, the cranes
> Take wing and over ocean speed away.
> Woe to the land of dwarfs! prepared, they fly
> For slaughter of the small pigmean race."

They are also mentioned by Pliny and by Strabo. By Pomponius Mela they are placed in a certain part of Arabia, while Jovius placed them in the extremity of the northern regions, confounding them probably with the Laps, the Ostiaks, and the Esquimaux, who are of small stature. The contest of the pigmies with the cranes is mentioned by Opian in his Halleutics, and by Juvenal in his Satires. "Gibbon, pro-

perly enough," says Beloe, the English translator of Herodotus, "treats the whole as a contemptible fable." How far this confident judgment is justifiable will appear when I state what I have seen.

This account of Homer has been thought fabulous, for, "How," it has been asked, "could cranes attack a race of men?"

Where were these pigmies to exist? I will try to show that Homer had some reason to say what he wrote. In the first book which I published (called "Explorations in Equatorial Africa"), I did not mention what Homer had written; I had heard of the dwarfs, but I dismissed the account given to me by the Opinge as fabulous. In chap. xiv., page 223 (English edition), I say:

"The dry season was now setting in in earnest, and I devoted the whole month of July to exploring the country along the sea shore. It is curious that most of the birds which were so abundant during the rainy season had by this time taken their leave, and other birds in immense numbers flocked in to feed on the fish, which now leave the sea shore and bars of the river mouth and ascend the river to spawn."

In the four paragraphs in advance on the same page, I said: "Birds flocked in immense numbers on the prairies, whither they came to hatch their young.

"The ugly marabouts, from whose tails our ladies get the splendid feathers for their bonnets, were there in thousands. Pelicans waded on the river's banks all day in prodigious swarms, gulping down the luckless fish which came in their way."

In the next paragraph, page 224, I continue:

"And on the sandy point one morning, I found great flocks of the *Ibis religiosa* (the sacred Ibis of the Egyptians), which had arrived over night; whence, I could not tell.

"Ducks of various kinds built their nests in every creek and on every new islet that appeared with the receding waters. I used to hunt those until I got tired of duck meat, fine as it is. Cranes, too, and numerous other water fowl flocked in every day, of different species. All come, by some strange instinct, to feed upon the vast shoals of fish which literally filled the river.

"On the sea shore I sometimes caught a bird, the *Julia crapensis*, which had been driven ashore by the treacherous waves to which it had trusted itself, and could not for some mysterious reason get away again.

"And, finally, every sand bar is covered with gulls, whose

shrill screams are heard from morning till night as they fly about greedily after their finny prey."

I terminated the description by saying: "It is a splendid time now for sportsmen, and I thought of some of my New York friends who would have enjoyed the great plenty of game that was now here."

In chapter xiii. of the same book, page 199, I wrote:

"From Igalé to Amambra was two hours' walk, through grass fields, in which we found numerous birds, some of them new to me. One in particular, the *Myctena Senegalensis*, had such legs that it fairly outwalked me; I tried to catch it, but though it would not take to the wing, it kept so far ahead, that I could not even get a fair shot at it.

"These *Myctena Senegalenses* are among the largest of cranes; they have a long neck and a very powerful beak, from eight to ten inches in length, and I killed several of them, which I brought back. I had grand shooting with them, and many a time I gave up the chase, but when I killed some I took good care to see that the bird could not hurt me and was quite dead before I approached it."

Hence I conclude that the description of Homer is correct, as regards the great number of cranes; and he was correct when he wrote: "And from incessant showers escaping," for you see that they came in the dry season, and when the rains came they disappeared from the country.

The dwarfish race of whom I speak are great hunters, and is it not probable during the wet season the crane came, there was rejoicing in the pigmean race?—for there would be food and meat for them and they would fight also with the large crane, the *Myctena Senegalensis*, which probably they could not kill at once, and hence it required on the part of the dwarfs great dexterity to capture them. For myself, I was always careful in approaching the *Myctena Senegalensis*, whose height is from four to five feet, as I have said, when quite clear. The natives, as I approached the first that I killed, shouted to me, "Take care, he will send his beak into your eye."

Now let us come to a more modern account of the dwarfs. We read the following in Rev. Dr. Krapf's "Travels and Missionary Labors in East Africa":

"Noteworthy are the reports which in the year 1840 were communicated to me by a slave from Enarea, who, by order of the King of Shoa, was charged with the care of my house in Angolala, during my residence in Onkobez. His name was Dilbo, and he was a native of Sabba, in Enarea. As a youth,

he had made caravan journeys to Kaffa and accompanied the slave hunters from Kaffa to Tuffte, in a ten-days' expedition, where they crossed the Omo, some sixty feet wide, by means of a wooden bridge, reaching from thence to Kullu in seven days, which is but a few days' journey from the Dokos, a pigmy race of whom Dilbo told almost fabulous stories." (Page 50.) Then Dr. Krapf gives an account of Dilbo, which does not bear on the subject to-night, and then continues:

"He told me that to the south of Kaffa and Sura there is a very sultry and humid country, with many bamboo woods (meaning, no doubt, palm tree), inhabited by the race called Dokos, who are no bigger than boys ten years old; that is, only four feet high. They have a dark, olive-colored complexion, and live in a completely savage state, like the beasts, having neither houses, temples, nor holy trees, like the Gallas, yet possessing something like an idea of a higher being, called Yer, to whom, in moments of wretchedness and anxiety, they pray; not in an erect posture, but reversed, with the head on the ground, and the feet supported upright against a tree or stone. In prayer, they say, 'Yer, if thou really dost exist, why dost thou allow us thus to be slain? We do not ask thee for food and clothing, for we live on serpents, ants, and mice. Thou hast made us, why dost thou permit us to be trodden under foot?' The Dokos have a chief, no laws, no weapons; they do not hunt nor till the ground, but live solely on fruits, roots, mice, serpents, ants, honey, and the like, climbing trees and gathering the fruits like monkeys, and both sexes go completely naked. They have thick protruding lips, flat noses, and small eyes. The hair is not woolly, and is worn by the women over the shoulders. The nails on the hands and feet are allowed to grow like the talons of vultures, and are used in digging for ants and in tearing to pieces the serpents, which they devour raw, for they are unacquainted with fire. The spine of the snake is the only ornament worn round the neck, but they pierce the ears with a sharp pointed piece of wood.

"The Dokos multiply very rapidly, but have no regular marriages, the intercourse of the sexes leading to no settled home, each in perfect independence going whither fancy leads. The mother nurses her child only for a short time, accustoming it as soon as possible to the eating of ants and serpents; and as soon as the child can help itself, the mother lets it depart whither it pleases. Although these people live in thick woods and conceal themselves among the trees, yet they become the prey of slave hunters of Sura, Kaffa, Dumbaw, and Kulla."

XUM

Then Dr. Krapf adds that they are never sold beyond Enarea. Then he continues as follows:

"Yet I can bear witness that I heard of these little people not only in Shoa, but also in Ukambani, two degrees to the south, and in Barava, a degree and a half to the north of the equator. In Barava a slave was shown to me who accorded completely with the description of Dilbo. He was four feet high, very thick set, dark-complexioned, and lively, and the people of the place assured me that he was of the pigmy race of the interior. It is not impossible, too, that circumstances, such as continual rains from May to January, and other means, may contribute to produce a diminutive people of stunted development in the interior of Africa. *A priori*, therefore, the reports collected from different and mutually independent points of Africa cannot be directly contradicted; only care must be taken to examine with caution the fabulous element mixed up with what may be true, by native reporters. In the Suali dialect, 'dogo' means small, and in the language of Enarea, 'doko' is indicative of an ignorant and stupid person."

Such is the account of this traveller. And let me now return to my own experience.

In traversing one of the tracts of the wild forest, through which was the highway of the country, we came suddenly upon a cluster of most extraordinary diminutive huts, which I should have passed by, thinking them to be some kind of fetich houses, if I had not been told that we might meet in this district with villagers of a tribe of dwarf negroes, who are scattered about Ishog and Ashango countries and other parts farther east.

The sight of these extraordinary dwellings filled me with curiosity, for it was really a village of this curious people. I rushed forward hoping to find some at least of their tenants inside, but they had fled at our approach into the neighboring jungle.

The huts were of a low, oval shape, like gipsy tents; the lowest part, that nearest the entrance, was about four feet of the ground; the greatest breadth was also four feet. On each side were three or four sticks for the man and woman to sleep upon. The huts were made of flexible branches of trees, arched over and fixed into the ground at each end, the longest branches being in the middle and the others successively shorter, the whole being covered with large leaves. When I entered the huts I found in each the remains of a fire in the middle of the floor.

Near the village of Niembouai, in the Ashango country, I had the pleasure of seeing the first dwarf. The astronomical position of Niembouai was determined by my meridian altitude of two stars, and by lunar distances for the longitude. The meridian altitude of the star Anteres gives the latitude of Niembouai to be 1° 58′ 47″, and the meridian altitude of Arcturus, 1° 59′ south of the equator.

I took lunar distances, east and west, of the moon to the number of twenty-one; these were between the moon and the planet Jupiter; these distances put together make the longitude of Niembouai at 10° 56′ 38″ E. longitude of Greenwich. The altitude of Niembouai itself was 1896 feet above the level of the sea.

The geographical position of Niembouai is now settled, and will hereafter show as the extreme western point where the dwarfs dwell. They doubtless inhabit the wooded equatorial regions of Central Africa. And now I will proceed to give some account of them.

In my former explorations I have heard of the Obongos in the Apingi country, but dismissed the subject, not believing what the people said about them.

Before reaching Niembouai, about twenty or thirty miles westward of it, as I was making my way towards the east with the people of the Ishogo tribe, we suddenly stepped in the midst of the huts of the Obongos. These were situated not far from a town called Yengue.

My astonishment was great, indeed, and for a while I could not believe that these shelters were the habitations of human beings. They were so small and so unlike any that I had seen before, I thought them to be fetich houses, but the Ishogos assured me that they were the shelters of a people called Obongo—a race of dwarfs.

My incredulity was so great that I was loth to believe.

I had hardly arrived in Niembouai when I heard that there was a village or settlement of the Obongos, or dwarfs, somewhere in the neighborhood of the village, and one of my first inquiries was whether I could possibly see them. It appeared that these Obongos continually came into the village of Niembouai, but would not do so while I was there. The Ashango were willing for me to go, and even offered to accompany me to the Obongo village. I was told, however, that I had better take with me only a very small party, so that we might make as little noise as possible. Two guides were given me and I took only three of my own men.

We had not left the village twenty minutes when, in a

retired nook of the forest, I saw twelve huts of this strange race, scattered without order, and covering altogether only a very small space of ground. These huts were exactly of the same shape and height as those I had seen before near Yengue. There was no mistake about it, and I was actually on the track of the dwarfs.

When we approached, no sign of a living creature was to be seen, and, in fact, we found them deserted. The people had left a few days before. This was a great disappointment. I learned here for the first time that the Obongos were continually moving from one place to another. The huts I have described to you are so easily made, one hour being quite sufficient to build one.

These abodes were very filthy, and while my Commi men and myself were endeavoring to examine them we were covered with swarms of fleas, and obliged to beat a retreat. The village or encampment had been abandoned by its inhabitants.

Leaving the abandoned huts, we continued our way through the forest, walking with the greatest caution. Presently, within a distance of a quarter of a mile, we came on another village, composed exactly like the last, of about a dozen ill-constructed huts, scattered about without any regular order, in a small open space. We approached with the greatest caution, in order not to alarm the wild inmates, each Ashango guide holding up a bunch of beads in a friendly way in his hand. But all our care was fruitless; the Obongos had heard us, and all the men were gone when we came up. Their flight was very hurried, but I got a glimpse at some of them as they ran. When I saw them running away I hastened with the utmost speed to the huts, and luckily found three old women and a young man, adult, who did not have time to run away, besides several children, the latter hidden in one of the shelters.

What a strange sight! I was at last in presence of the dwarfs. There was now no mistake. And how strange and small these creatures looked.

My Ashango guides tried their best to calm the fears of the trembling creatures, telling them that I had come to do them no harm, but had brought some beads as presents for them.

I finally succeeded in approaching them, for fear seemed to have paralyzed their powers of locomotion. They did not dare to look at me. I gave them some beads, and then requested my Ashango guides to tell them that we should

come back the next day with more beads to give to all the women of the village, and that they must be all there.

One of the three women in a short time lost all her shyness, and began to ridicule the men for having run away from us. She said they were as timid as the nchende (a squirrel), who cried "Que! que!" and in squeaking she twisted her little body into such odd contortions that we all were obliged to laugh.

When I saw that I had tamed her sufficiently, I brought out my tape to measure her; her fears returned, and she began to cry, probably thinking that it was some kind of a snake that I was uncoiling out of its case. She trembled all over, but at last I accomplished my purpose.

I waited an hour in the vain hope that the men might return to their huts, but no Obongos made their appearance. These Obongos could speak the Ashango language, and this being the same as the Ashna, I was able to understand them tolerably well. By the way, the Obongo women seem to know how to tell lies as well as their country women of larger growth, for when I inquired where the rest of the people were, they replied at once that they were gone in the forest to fetch fire wood and trap game, thinking that I had not seen them run away.

Such was my first interview with the pigmean race of men.

The next day I went again to their settlements and I saw only one woman and two children. I had not come early enough, as they had already left. Luckily the woman was one of those I had seen the day before. I gave her and the children a number of beads; then, suspecting that the mother of the children was in the hut close by where they stood, I went to it, took off the branch that had been put at the entrance to signify that the owner was out, and then putting half of my body into the hut, in the best way I could, after looking in vain in the dark, I at last discovered something which I soon recognized as a human being. I hallooed, but received no answer. At last I seized her by the leg, my Ashango shouting to her not to be afraid. Then she came out, and did not even look round to see if her children were there. I was told that she had lost her husband a few days before, when they lived in the now deserted village which I had seen on my way hither. She had over her forehead a broad stripe of yellow ochre. I at once wanted to know where they buried their dead and desired my Ashango guide to ask the women, but he told me I better not ask that question as they might get frightened, and the woman who

had just lost her husband might commence to cry. I suspect the Ashango man himself did not like that kind of conversation. I would have given anything for a skeleton of an Obongo. I gave the poor widow some beads and then left her again. My old friend Misounda invited me to come back in the afternoon, as she thought that the men would return from the woods. I returned accordingly in the course of the afternoon, but no men were to be seen.

On a subsequent visit I found the village deserted by the women as well as by the men; at least, as we approached it, the women who had heard us ran into their huts; among them I caught sight of my old friend Misounda running to hide herself. This was double disappointment, as I had flattered myself that I had quite tamed her. When we entered their settlements not a sound was to be heard, and the branches of the trees had been put up at the doors of all the huts to make us believe that all the people had gone into the woods. This was surely provoking, as in spite of all my friendly visits I had not yet succeeded in allaying their fears.

My Ashango guide shouted aloud, "We have come to give you more beads; where are you?" Not a whisper was heard, no one answered our call, but there was no room for any doubt that they were present, as we had seen the women enter the huts. I therefore went to the hut of my old friend Misounda, took off the branch, and called her by name; but there was no answer. It was so dark inside when I entered that I could see nothing; so I tumbled over the old woman. Finding that she was detected, she came out and pretended that she had been fast asleep. Then she called the other women, saying that I was not a leopard that had come to eat them.

I made several other visits to this village of Obongos during my stay in the Ashango village of Niembouai. I succeeded in measuring six women and one man.

	Feet.	Inches.
Woman No. 1.....Total Height,	4	$4\frac{1}{4}$
" " 2..... " "	4	$7\frac{1}{4}$
" " 3..... " "	5	$0\frac{1}{4}$
" " 4..... " "	4	8
" " 5..... " "	5	0
" " 6..... " "	4	5
Man..... " "	4	6

Their measurement round the head was from $21\frac{1}{4}$ to $22\frac{1}{3}$ inches. The men and women whom I have seen at different

times seemed to be of the average height I have described. The people measuring five feet were considered very tall; some of the women were smaller than those I have measured.

Afterwards I succeeded in seeing several other Obongos.

The color of these people was dirty yellow, much lighter than the Ashangos who surrounded them, though those Ashangos themselves were not very black. Their eyes had an untamable wildness about them that struck me as very remarkable. In their whole appearance, physique, and color, and in their habitations, they are totally unlike the Ashangos, or all the negro tribes I have seen. The Ashango people are very anxious to disown kinship with them. They do not intermarry with them. They have thick lips and flat noses like the negroes, and possess somewhat the negro type. Their foreheads are exceedingly low and narrow, and they have prominent cheek bones. The hair on their heads grows in very short curly tufts, looking somewhat like the hair of the bushmen of South Africa. This is the more remarkable, as the Ashango and other tribes in the midst of whom they are, have long, curly, bushy hair on their heads, which enables them to dress it in various ways, as I have shown in my work on Ashango Land. Many of the men had an unusual quantity of curly hair on their legs and on the breast, growing in short tufts similar to the hair of the head, and from all the accounts I have heard, I found that the Obongo men were generally as thickly covered with hair as those I have just described. One of the male Obongos I saw was quite black. I did not notice any peculiarity in their hands and feet, or in the position of their toes; the foot was thoroughly human, the length of their arms being in relative proportion to the rest of their bodies; but their legs appeared to be rather short in proportion to their trunks; the palms of their hands seemed tolerably white.

I did not see on them any fetiches, and there were no idols in their settlements.

Of course, the smallness of their communities, and the isolation in which the wretched creatures live, must necessitate close interbreeding. Their settlements are so wide apart that one of my first inquiries was, how did they marry? The Ashangos declare that the Obongos intermarry among themselves, sisters with brothers, in order to keep the families together as much as they can. I think that this circumstance may lead to the extinction of their race.

The Ashangos give to the Obongos their worn out denguis

out of pure kindness, and they are worn by the Obongos, some being entirely naked.

They neither plant nor sow; they are very expert and nimble in trapping wild animals, and fish in the streams. The surplus fish and game they sell to their neighbors in exchange for plantains, and also for iron implements, such as arrows—very few using spears, cooking utensils, water jars, callebashes, and all manufactured articles of which they stand in need. The woods near their villages are so full of traps and pitfalls that it is dangerous for any but trained woodsmen to wander about in them. From the path leading to their settlements I took traps for monkeys, also traps for leopards, antelopes, and wild boars, and they could be seen everywhere. They also eat the nuts and berries of the forests.

The Ashangos and other tribes like the presence of this curious people near their villages, for they get a good deal of their meat from them. I was surprised at the kindness shown by the Ashangos to their diminutive neighbors. On one of my visits to the village I saw about a dozen women from Niembouai, who had come with plantains to exchange for game, which they expected to be brought in by the men. Our little hunters had not returned from the forest; they were disappointed in this errand; but seeing that the Obongo women were suffering from hunger, nuts being scarce at that time of the year, they left nearly all the plantains with them as a gift.

The Obongos never remain long in one place, they are eminently a migratory people, moving from place to place whenever game becomes scarce, but they do not often wander very far; that is, the Obongos who live within the Ashango territory do not go out of that territory, or, at least, do not remain away for a long time. They are called the Obongos of the Ashangos; those who live among the Njavi are called Obongo-Njavi, and the same is the case with other tribes. Obongos are said to exist very far to the east, as far as the Ashangos and Obongos themselves have any knowledge. They are similar to the gipsies of Europe, distinct from the people among whom they live, yet living for generations within the confines of the same country. They spend most of their lives in the forest in search of berries, nuts, and game. When they can no longer find game in the locality where they have made their temporary settlements, and nuts and berries, then they steal food from the plantations of their more civilized neighbors, and decamp. Their appetite for animal food is more like that of a carnivorous beast than that of man.

Though in that country, where game is so scarce, men are very voracious.

One day I enticed the old woman Misounda, of whom I have spoken above, to come to Niembouai, simply by promising her a joint of a goat. When she came I tried to put her off with a bunch of plantains, but she remained tenaciously before my hut till I had fulfilled my promise and given her some meat.

I wanted very much to get a skeleton of these Obongos, but did not succeed, for I did not dare to broach the subject. The modes of burial of these savages, as related to me by the Ashangos, are curious. First, they want to keep the place of burial of an Obongo a profound secret from the tribe among whom they live. The most common way after an Obongo is dead, is for the people of his race to find a hollow tree in the forest, to which they ascend with the corpse and then let it down into the hollow, filling up the remaining space with branches and leaves mixed with earth; at other times they will make a hole in the bed of a running stream, diverting the current for the purpose, and then after the grave is covered in, turning back the rivulet to its former course. This last mode of burial reminds one of the burial of Attila.

In drawing to a close, I may remark that Etearchus conjectured the river of the dwarfs to be the Nile, and, as Herodotus said, reason favors this view. Homer and Aristotle place them near the sources of the Nile, which would agree with the position given by Krapf to the Dokos.

Pliny (vol. vi., p. 19) places them in India.

Strabo thinks that certain little men of Ethiopia were the original dwarfs.

Pomponius Mela places them far south, and speaks of their fighting with cranes.

In latter days, Dr. Krapf places them, as you have seen, near the equatorial regions. The account he gives of what he had heard, agrees in many respects with what I saw. The sultry air, humid land, with bamboo woods, meaning palm-tree woods, are nothing else but the humid forests of Equatorial Africa, for the bamboo is probably not a native plant of this country. The Dokos were no bigger than boys ten years old, that is, only four feet high. They have a dark olive-colored complexion, and live in a completely savage state, like the beasts. They live solely on fruits, roots, mice, serpents, ants, honey, and the like. All the natives I have described eat such things, with the exception of ants

—serpents, and mice, being considered great dainties, the Obongos love serpents and mice.

The word Doko, Dogo, is not what those dwarfs apply to themselves, but Dr. Krapf calls them thus.

The assertion of Herodotus, that the dwarfs were men under the middle height, is quite correct, as seen by my measurements.

We are therefore led to the conclusion that the Obongos are the pigmy race spoken of by Homer, the dwarfs mentioned by Herodotus, and the Dokos described by Dr. Krapf. I have not the slightest doubt that they are scattered all over the equatorial regions and forests of Africa. They themselves and the natives pointed to the east as the regions they came from.

I have no doubt but that in the time of Herodotus and of Homer these pigmies lived near the sources of the Nile, and are the very race I have found. Since then many political convulsions have visited Africa, as Burton and Speke have shown us in their works; wars, conquests, and slavery have swept over the land of the dwarfs, and they have sought refuge in the fastnesses of the forests of Central Africa. Now they have dwindled down like many other races, and live scattered in small communities.

Now we know that a dwarfish race exists and has existed for ages past. These analogies of nature we find everywhere. There are families of dwarf trees, and why should there not be races of dwarf men?

This record of the Obongos will stand, for truth can never be obliterated.

End